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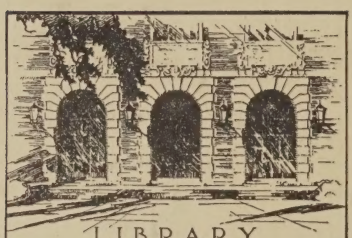

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SARGENTIA

A CONTINUATION OF THE
CONTRIBUTIONS FROM THE ARNOLD ARBORETUM
OF HARVARD UNIVERSITY

I

FIJIAN PLANT STUDIES, II

Botanical Results of the 1940–41 Cruise of the "Cheng Ho"

BY

A. C. SMITH (and collaborators)

WITH FIVE TEXT-FIGURES

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1942

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A CONTINUATION OF THE CONTRIBUTIONS FROM THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY

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SARGENTIA

A Continuation of the
Contributions from the Arnold Arboretum
of Harvard University

No. I, pp. i–iv, 1–148, with five text-figures
Issued July 20th, 1942

This first number of Sargentia is dedicated to Mrs. Anne Archbold, of Washington, D. C., in appreciation of her interest in and support of botanical investigations through the Philippine–Moluccas and the Pacific cruises of the "Cheng Ho," 1939–1941.

Printed by the Lancaster Press, Inc.
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SARGENTIA: A WORD OF EXPLANATION

E. D. Merrill

In 1932 there was established at the Arnold Arboretum a series of publications under the general title of "Contributions from the Arnold Arboretum of Harvard University," planned to accommodate larger papers that were too extensive for publication in ordinary serial literature. Between 1932 and 1938 eleven numbers of this series appeared, varying in size from 91 to 230 pages each, as listed on the third page of the cover of the present publication. This new series, under the one-word title Sargentia, is planned to take similar future papers, and it is expected that future numbers will be issued at irregular intervals as material becomes ready for publication and as funds may be available to cover printing costs.

From long bibliographic experience, I have become more and more impressed with the desirability of simple one-word titles for periodicals. The principle of one-word titles was established, in the botanical field, early in the past century, with such serials as Linnaea (1826–1882), Flora (1818–1942), and numerous others, but for the most part the titles of scientific periodicals, in botany as in other branches of science, have been composed of several words. Not infrequently these titles are unduly long and cumbersome, causing considerable difficulties to bibliographers who must cite them in some intelligible abbreviated form. Generally speaking, individuals connected with sponsoring institutions have felt impelled to use in their titles the name of the institution or organization that supports the publication, without much regard for convenience, descriptiveness, or brevity. My personal feeling is that there is little need of glorifying the name of the sponsoring unit when a short and appropriate title may be evolved from the name of some individual prominent in the history and development of the institution itself.

Thus, in 1925, while serving as Dean of the College of Agriculture of the University of California, dissatisfied with a very long and cumbersome title for one series of technical papers that had been established in 1923, I discontinued this series and established in its place the technical periodical Hilgardia, with a descriptive subtitle "A Journal of Agricultural Science published by the California Agricultural Experiment Station." This, the first real serial in the history of the vast American Agricultural Experiment Station literature, other than the "Experiment Station Record" published by the United States Department of Agriculture, is now in its fourteenth volume and is still the only periodical in this field with a one-word title. It was named in honor of an outstanding pioneer in agricultural education and research, Dr. Eugene Woldemar Hilgard (1833–1916), who organized the agricultural department of the University of California and who founded the California Agricultural Experiment Station in 1875. In 1931, while serving as Director of the New York Botanical Garden, I established the technical periodical Brittonia, named in honor of Dr. Nathaniel Lord Britton, who organized the Garden and served as its first Director, from 1896 to 1929; the descriptive subtitle in this case was "A series of botanical papers." This is now in its fourth volume. Finally, in 1941, the name of the Arnold Arboretum's

"Bulletin of Popular Information" (1911–1940) was changed to ARNOLDIA, with an explanatory subtitle "A continuation of the Bulletin of Popular Information of the Arnold Arboretum, Harvard University." This title honors James Arnold (1781–1868), whose bequest of $100,000 in 1868 led to the establishment of the institution that bears his name.

The selection of the name SARGENTIA for this new series of technical papers needs little explanation. It is dedicated to Dr. Charles Sprague Sargent (1841–1927), who organized the Arnold Arboretum and served as its first Director from 1872 until his death in 1927. It was due to Dr. Sargent's vision, ability, initiative, and support that, from the small beginnings of 1872, there was built up during his lifetime an institution national and international in character, widely and favorably known not only as a garden famed for the beauty of its landscape and for the vast number of living plants that make up its collections, but also as an outstanding research institution with its unsurpassed library, its great herbarium, and its laboratories, and as a publishing institution ranking high in its field. It seems to be eminently fitting that this series of papers, sponsored by the institution that essentially represents the life-work of Charles Sprague Sargent, should bear his name.

FIJIAN PLANT STUDIES, II[1]

BOTANICAL RESULTS OF THE 1940–41 CRUISE OF THE "CHENG HO"

A. C. Smith (and collaborators)

with five text-figures

The greater part of the material which forms the basis of this treatment was collected in Fiji in 1940–41 by Mr. Otto Degener, a member of the Pacific cruise of the "Cheng Ho," sponsored by Mrs. Anne Archbold. The botanical collections were made with the cooperation of the Arnold Arboretum and the New York Botanical Garden. Mr. Degener obtained about 2100 field numbers, mostly represented by many duplicates. After the conclusion of his field work in June, 1941, additional specimens were collected and forwarded by one of his Fijian assistants.

The area covered by members of the expedition centered on the largest island, Viti Levu, where numerous regions near the coasts were visited. Mr. Degener also spent several weeks in the mountains of Tholo North Province, and additional work was done in the Savu Savu Bay region of Vanua Levu. A few smaller islands were briefly visited. Much of the credit for the success of Mr. Degener's work, he informs me, should be given to his several assistants, and especially to Emilio Ordonez of Honolulu and Aloisio Tabualewa and Timoci Bebe of Viti Levu. The collection was made possible primarily by the generosity of Mrs. Archbold, and to her the writer is especially grateful, as the material assembled during the cruise of the "Cheng Ho" proves to be of great importance in a study of the Pacific flora. It has been a pleasure for the writer and his associates to name several species in honor of Mrs. Archbold.

While working on the Degener material, I have taken the opportunity to reexamine many of the older collections, of which some specimens remained undetermined or only provisionally named. Material so studied, collected chiefly by John W. Gillespie and the writer, is cited in this treatment. I have also been fortunate in receiving recent shipments of Fijian plants from Mr. William Greenwood of Lautoka and Miss Lorna Reay of Nandarivatu, whom I wish to thank for their kind collaboration.

I have been privileged to examine material deposited in several institutions other than the Arnold Arboretum (A), namely the Bernice P. Bishop Museum (Bish), Gray Herbarium (GH), New York Botanical Garden (NY), University of California (UC), U. S. National Herbarium (US), and U. S. National Arboretum [Bureau of Plant Industry] (USNA). For the loan of certain groups from these institutions I am indebted to their respective Directors and Curators. Place of deposit, in the following citations, is indicated by the above parenthetical letters.

Several specialists consented to examine the material of selected families, and some of them have kindly permitted the incorporation of their discoveries in this

[1]See Bishop Mus. Bull. **141**: 1–166. *f. 1–83.* 1936.

paper. The author greatly appreciates the cooperation of the following students: Caroline K. Allen (Lauraceae), Agnes Chase (Gramineae), E. B. Copeland (Pteridophyta), Leon Croizat (Euphorbiaceae), F. R. Fosberg (Ebenaceae, Rubiaceae), Charles Gilly (Sapotaceae), R. A. Howard (Icacinaceae), E. P. Killip (Passifloraceae), C. E. Kobuski (Theaceae, Oleaceae), E. D. Merrill and L. M. Perry (Pandanaceae, Myrtaceae), H. N. Moldenke (Verbenaceae), Hugh O'Neill (Cyperaceae), W. T. Swingle (*Citrus*), L. O. Williams (Orchidaceae), and T. G. Yuncker (*Peperomia, Cuscuta*). Especial thanks are due Dr. E. D. Merrill, for his aid in making preliminary determinations, and Prof. I. W. Bailey, for suggestions concerning certain puzzling specimens. The extensive card-catalogue of Polynesian references compiled by Dr. Merrill, now being kept up to date at the Arnold Arboretum, has been of the greatest value in bibliographic work, as has also his Polynesian Botanical Bibliography, 1773–1935 (Bishop Mus. Bull. **144.** 1937) and its manuscript supplement. The text-figures have been prepared by Mr. Gordon W. Dillon, with the exception of one made by Dr. Howard.

In this treatment only new and unusual plants are discussed, in the hope that further study of the Fijian flora will permit re-description of all the plants known from the archipelago. Ninety-one species, eight varieties, and two forms are described as new; 63 of these entities are based on the collections of Mr. Degener and his assistants (at least as regards the type specimen), while the remaining 38 are based on earlier collections. In addition it has been found necessary to propose 43 new combinations and six new names. An additional 53 species or varieties are reported from Fiji for the first time (at least in strictly botanical literature); of these, 17 are apparently indigenous while 36 are weeds or otherwise introduced plants.

Of particular interest are several families which have not previously been reported from Fiji; these are the Balanopsidaceae and Lobeliaceae (represented by indigeous plants), and the Bromeliaceae, Crassulaceae, Polygalaceae, Bixaceae, Turneraceae, Lythraceae, and Onagraceae (represented by non-indigenous plants). The following genera, containing indigenous species, are first reported from Fiji: *Heliconia, Trilocularia, Pseudomorus, Decringia, Desmos, Xylopia, Pucraria, Drypetes, Trigonostemon, Citronella, Harpullia, Gonystylus, Pemphis, Dyschoriste,* and *Lobelia.* Non-indigenous species represent the following genera which appear to be otherwise unrecorded from Fiji in botanical literature: *Ananas, Bryophyllum, Chrysobalanus, Schrankia, Polygala, Koelreuteria, Bixa, Turnera, Cuphea, Lawsonia, Clidemia, Jussiaea, Catharanthus, Operculina, Quamoclit, Lantana, Pogostemon, Thunbergia, Coccinea, Mikania, Spilanthes, Synedrella,* and *Youngia.* Doubtless some of the introduced species and genera which I here presume to record as new to Fiji have already been reported from the group. Members of the very active Department of Agriculture in Fiji have long been occupied with a study of weed-control, as indicated by numerous papers in the Agricultural Journal of the Department of Agriculture, Fiji, now in its thirteenth volume. As publications of this sort are often not available to botanical students, I take the liberty of listing certain "new records" which actually are new only to the specialized taxonomic literature.

From the viewpoint of phytogeography, probably the most interesting species discussed in this paper are *Trilocularia vitiensis* (Balanopsidaceae), *Desmos insularis* (Annonaceae), and *Gonystylus punctatus* (Thymeliaceae), which represent substantial extensions of generic ranges. In the Orchidaceae, *Acanthophip-*

pium vitiense L. O. Williams (in Am. Orch. Soc. Bull. **10**: 169. 1941), based on the Degener collection, represents a notable generic range-extension. The following genera are revised for the region and keys to the Fijian species proposed: *Elatostema, Procris, Pipturus, Homalium, Phaleria, Medinilla, Astronidium, Couthovia,* and *Hoya.*

Families and genera are discussed in the order established in Dalla Torre and Harms, Genera Siphonogamarum.

POLYPODIACEAE

By E. B. Copeland

Tectaria Degeneri Copeland, sp. nov.

Inter *T. latifoliam* et *T. Godeffroyi;* stipite et rhachibus ebeneis nitidis; lamina ovata, 60 cm. lata, bipinnata, pinnis suboppositis inferioribus pedicellatis; pinnis infimis 45 cm. longis, pinnulis infimis sessilibus, usque ad 20 cm. longis et 2 cm. latis sinuato-lobatis, sequentibus 1–2-paribus adnatis conformibus, pinnis plerisque ad alam 2–10 mm. latam pinnatifidis segmentis linearibus sinuatis, obscuris, tenuiter herbaceis, glabris; venis laxe anastomosantibus cum liberis ramosis vel hamatis inclusis; soris sparsis, dorsalibus, indusio plerumque carente, hic illuc vestigiale fusco.

Viti Levu: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14478* (GH, Herb. E. B. Copeland, type), Feb. 24, 1941 (in rich forest; native name: *turalo*), *Degener 14873* (GH, Herb. E. B. Copeland) (in dense forest; native name: *turalo;* fronds edible when boiled).

One of the group of *T. latifolia;* more particularly related to *T. Godeffroyi,* and apparently representing a stage in the evolution of the latter species. The pinnules, respectively the segments of pinnatifid pinnae or parts of pinnae, are remarkably slender.

Tectaria elegans Copeland, sp. nov.

Adesse videtur pars medialis profunde bipinnatifida frondis; rhachi 3 mm. crassa, brunnea, minutissime velutina; pinnis contiguis, subsessilibus, horizontalibus, 40–45 cm. longis, 10–12 cm. latis, acutis, basi rotundatis, ad alam latam pinnatifidis; segmentis permultis contiguis, ca. 7 cm. longis, 18 mm. latis, acutis, inciso-serratis dentibus 2 mm. longis et latis, herbaceis, glabris; venis areolas perlongas costas secus includentibus, alibi laxe anastomosantibus venulis inclusis nullis; soris ad venas anastomosantes dorsalibus, inferioribus interdum oblongis caeteris permultis orbicularibus, indusiis ferrugineis reniformibus caducis.

Vanua Levu: Thakaundrove: Savuthuru Mt., Savu Savu Bay region, alt. about 300 m., *Degener & Ordonez 15544* (GH, Herb. E. B. Copeland, type), Dec. 1940 or Jan. 1941.

In spite of the relatively well developed reticulation of the veins, the affinity seems to be to *Pleocnemia.*

Arthropteris Archboldiae Copeland, sp. nov.

A. tenellae affinis, soris indusiatis distincta; rhizomate late scandente, 1 mm. crasso, paleis nigris acutis 0.3–0.5 mm. longis plerisque appressis vestito; pedicellis ca. 2 mm. longis; stipitibus ca. 1 cm. longis inconspicue articulatis; lamina 20–25 cm. longa, deorsum angustata pinnis remotis, rhachi inferne velutina; pinnis sessilibus, superioribus usque ad 4 cm. longis et 8 mm. latis subacutis obscure crenulatis, basi acroscopice obscure auriculatis basiscopice anguste cuneatis, herbaceis, glabris; soris inframedialibus, parvis, indusiis fuscis, reniformibus vel orbiculari-reniformibus.

VITI LEVU: Ra: Southwest of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15514* (GH, Herb. E. B. Copeland, TYPE), June 7, 1941 (climbing smooth-barked trees in dense forest).

Arthropteris tenella (Forst.) J. Sm. is a reasonably uniform species in New Zealand, Norfolk Island, and Australia, its rhizomes bearing squarrose, rusty, more ample paleae, and its sori being naked. It has been reported from New Caledonia, but two specimens described below represent an intermediate species, suggestive on the one hand of *A. tenella* and on the other of *A. Archboldiae*.

Arthropteris neocaledonica Copeland, sp. nov.

A. tenellae affinis, major, paleis nigris acutis appressis, soris nudis e facie superiore pinnae punctiforme expressis.

Rhizome 2 mm. thick; stipe 5 mm. long; lamina 30–40 cm. long; largest pinnae 6 cm. long, 11 mm. wide, medial (not distal), truncate rather than auricled on the upper side at the base.

NEW CALEDONIA: Mt. Koghi, alt. 300 m., *Franc 834* (UC, TYPE [no. *393175*]), *Franc 2001* (UC).

The new species is like *A. tenella* in most respects, but like *A. Archboldiae* in its black paleae, and unlike both in having the position of the sorus well marked on the upper surface.

PANDANACEAE

By E. D. MERRILL AND L. M. PERRY

Freycinetia Degeneri Merr. & Perry, sp. nov.

Scandens; ramulis apicem versus ± 6 cm. crassis, internodiis brevissimis 2–3 mm. longis; foliis 20–25 cm. longis, ± 9 mm. latis, sensim attenuato-acuminatis fere subulatis, margine in parte basilari et apicali media saepissime breviter et inconspicue serrato-denticulatis, costa ultra medium in pagina inferiore remote et minute denticulata, auriculis demum ± solutis deciduis; inflorescentiis terminalibus circiter 5 cm. longis; spathis caducis; pedicellis fere 3 cm. longis parcissime et minute spinuloso-setosis tantum; syncarpiis 3-nis subglobosis, immaturis 1.5 cm. diametro vel 1.5 cm. longis, 1 cm. diametro; baccis numerosis sublinearibus vel sublageniformibus angulatis, in sicco circiter 4–5 mm. longis fere ad basim liberis, apice annulo cinctis; stigmatibus 2–4.

VITI LEVU: Serua: Vatuvilakia, vicinity of Ngaloa, in forest, alt. 0–150 m., *Degener 15128* (A, TYPE), May 1941 (liana; fresh roots pounded and fibers used in binding grass for houses).

This species may be related to *Freycinetia Hombronii* Martelli of Samoa, but it differs in the smaller leaves with deciduous auricles and the practically glabrous pedicels of the syncarps.

Freycinetia intermedia Merr. & Perry, sp. nov.

Scandens; ramulis apicem versus 6–10 mm. diametro, internodiis brevibus circiter 5 mm. longis; foliis 30–45 cm. longis, usque 2 cm. latis, sensim attenuato-acuminatis caudatis, cauda 3–3.5 cm. longa, margine in parte basilari et apicali (cauda praecipue) serrato-denticulatis, media saepissime integris, costa in pagina inferiore (basim versus excepta) minute et remote spinuloso-serrata, auriculis demum solutis deciduis; inflorescentiis terminalibus ± 6 cm. longis, spathis caducis, pedicellis glabris; syncarpiis 3-nis immaturis oblongis, 2 cm. longis, ± 1 cm. latis; baccis parte inferiore excepta liberis sublinearibus angulatis, apice annulo levi cinctis; stigmatibus saepissime 3–4.

VITI LEVU: Serua: Mount Ngamo, vicinity of Ngaloa, in forest, alt. 0–150 m., *Degener 15054* (A, TYPE), April 1941 (liana; roots softened and pounded in water and bark removed, then used as string for house-building; native name: *wa me*).

This species is most like *Freycinetia Milnei* Seem. and *F. Pritchardii* Seem. It differs from the first in the shorter and narrower leaves and the smaller syncarp; from the second it may be distinguished by the shape of the berries.

TRIURIDACEAE

Andruris vitiensis (A. C. Sm.) Giesen in Pflanzenr. 104 (IV. 18): 28. 1938.

Sciaphila vitiensis A. C. Sm. in Bishop Mus. Bull. **141**: 15. *f. 5.* 1936.

VANUA LEVU: Thakaundrove: Eastern drainage of Yanawai River, alt. 120 m., *Degener & Ordonez 14077* (GH) (in leaf-mould in dense forest; entire plant purplish red).

This is the second collection of the species (and family) known to me from Fiji, the type having been obtained on Vanua Mbalavu. Mr. William Greenwood writes that he has collected a specimen of the family near Lambasa, on the north coast of Vanua Levu, but this collection is not available to me.

GRAMINEAE

(determinations by Agnes Chase)

The only modern comprehensive lists of the grasses known from Fiji were published by Summerhayes and Hubbard (in Kew Bull. **1927**: 18–44. 1927; **1930**: 252–265. 1930); 71 species were reported by them. The present collection includes five species which they did not list and which appear to be unrecorded from the group, while five other species were reported by Summerhayes and Hubbard under different names from those in use in the U. S. National Herbarium. In order to record these names in the literature dealing with Fijian plants, the following ten species are listed.

Microstegium glabratum (Trin.) A. Camus in Ann. Soc. Linn. Lyon n. s. **68**: 201. 1921.

VITI LEVU: Tholo West: Lumuka, vicinity of Mbelo, near Vatukarasa, alt. 240 m., *Degener 15222* (GH, US) (forming thick patches on sunny moist slopes; native name: *omanuna*); Serua: Waimbale near Namboutini, *Degener 15472* (GH, US) (in sunny wet clearing in forest). VANUA LEVU: Thakaundrove: Uluinabathi Mt., Savu Savu Bay region, alt. 60 m., *Degener & Ordonez 13932* (GH, US) (gregarious on wet sunny slopes).

This species, presumably not uncommon in Fiji, was reported as *Pollinia glabrata* Trin. by Summerhayes and Hubbard (p. 28, 254).

Andropogon annulatus Forsk. Fl. Aegypt. Arab. 173. 1775.

VITI LEVU: Rewa: Vicinity of Suva, *Degener & Ordonez 13512* (GH, US) (roadside weed, along shore).

Reported by Summerhayes and Hubbard (p. 29, 255) as *Dichanthium annulatum* (Forsk.) Stapf.

Andropogon glaber Roxb. Fl. Ind. **1**: 271. 1820.

VITI LEVU: Tholo North: Korovou, east of Tavua, alt. 60–90 m., *Degener 14960* (GH, US) (on dryish grassy plain; native name: *othangithangi*).

Mentioned by Summerhayes and Hubbard (p. 29, 254) as *Amphilophis glabra* (Roxb.) Stapf.

Panicum oxyphyllum Hochst. ex Steud. Syn. Pl. Gram. 65. 1854.

VITI LEVU: Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, alt. 300 m., *Degener 15231* (GH, US) (in forest). VANUA LEVU: Thakaundrove: Between Valanga and Valethi, near sea-level, *Degener & Ordonez 14037* (GH, US) (edge of forest).

In mentioning this species as *Cyrtococcum oxyphyllum* (Hochst.) Stapf, Summerhayes & Hubbard (p. 38, 259) imply that the plants which Seemann (Fl. Vit.

325. 1873) cites as *Panicum trigonum* Retz. belong here. The species is common in Fiji.

Panicum trigonum Retz. Obs. Bot. **3**: 9. 1783.

VANUA LEVU: Thakaundrove: Waina, Maravu, near Salt Lake, alt. 15 m., *Degener & Ordonez 14149* (GH, US) (in shrubby pasture).

If Summerhayes and Hubbard are correct in referring Seemann's specimens of *"Panicum trigonum"* to *P. oxyphyllum* Hochst., as mentioned above, it would seem that the true *P. trigonum* is here first recorded from Fiji.

Panicum reptans L. Syst. Nat. ed. 10. **2**: 870. 1759.

VITI LEVU: Tholo North: Korovou, east of Tavua, alt. 60 m., *Degener 14959* (GH, US) (on dryish grassy plain).

Reported by Summerhayes and Hubbard (p. 35, 258) as *Urochloa reptans* (L.) Stapf. The name *Panicum reptans* appears in the literature pertaining to Hawaii and Micronesia.

Oplismenus undulatifolius (Ard.) R. & S. Syst. Veg. **2**: 482. 1817.

VITI LEVU: Tholo North: Nandarivatu, alt. about 750 m., *Degener 14384* (GH, US) (along forest trail).

Although mentioned from Australasia and other parts of the South Pacific, this species has been unreported from Fiji.

Setaria geniculata (Lam.) Beauv. Ess. Agrost. 51. 1812.

VITI LEVU: Rewa: Suva, near sea-level, *Degener & Ordonez 13514* (GH, US) (roadside weed).

Previously reported, in the Pacific, only from Hawaii.

Aristida aspera Swallen in Jour. Wash. Acad. Sci. **26**: 177. 1936.

MAKONDRONGA: *Degener & Ordonez 13810* (GH, US) (on dry forested slopes, alt. 60 m.).

The cited collection is of especial interest as representing the second collection of the species; the type is from Rapa.

Arundo donax L. Sp. Pl. 81. 1753.

VITI LEVU: Serua: *Degener 15170* (GH, US) (in open forest in rainy region, alt. about 120 m.; plant to 3 m. high; reed used in house-building; native name: *ngasau vavalangi*).

This species has been reported, in the Pacific, only from Hawaii.

BROMELIACEAE

Ananas comosus (L.) Merr. Interpret. Herb. Amb. 133. 1917.

Ananas sativus Schult. f. Syst. **7**(2): 1283. 1830; Christoph. in Bishop Mus. Bull. **128**: 47. 1935.

VITI LEVU: Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, alt. 300 m., *Degener 15238* (GH) (more or less naturalized in wet forest; native name: *vandra*).

I have not seen any other specimens of the common pineapple, nor of the family, collected in Fiji. Degener reports that the species does not grow in all parts of Viti Levu, but has been known for years in the cited locality. It is probably more common as an escape than the lack of herbarium records implies. Christophersen states that it is commonly found in a natural state in Samoa. The Fijian common name *vandra* is usually referred to *Pandanus tectorius* Sol.

MUSACEAE

Heliconia Bihai L. Mant. **2**: 211. 1771; K. Schum. in Pflanzenr. 1 (IV. **45**): 36. 1900; Christoph. in Bishop Mus. Bull. **128**: 54. 1935.

Viti Levu: Tholo North: Nauwanga, near Nandarivatu, alt. 750 m., *Degener 14352* (GH) (native name: *paka;* seeds edible when cooked); Naitasiri: Suva Pumping Station, alt. 90 m., *Degener & Ordonez 13988* (GH). Vanua Levu: Thakaundrove: Savu Savu Bay region, Vatunivuamonde Mt., alt. 300 m., *Degener & Ordonez 14011* (GH). Kandavu: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 193* (NY).

Although it is said to be common in Samoa, New Caledonia, and the Solomons, this widespread species has not previously been recorded from Fiji.

ZINGIBERACEAE

The conservation of *Alpinia* Roxb. over *Languas* Koenig (Kew Bull. **1940**: 95. 1940) makes necessary a new combination for a Fijian species.

Alpinia Parksii (Gillespie) comb. nov.

Languas Parksii Gillespie in Bishop Mus. Bull. **91**: 4. *f. 1.* 1932.

Vanua Levu: Thakaundrove: Savu Savu Bay region, Savuthuru Mt., alt. 90 m., *Degener & Ordonez 13821a* (GH) (herb to 3 m. high, in forest; fruit pale yellow); Vatunivuamonde Mt., alt. 300 m., *Degener & Ordonez 14043* (GH) (coarse herb to 3 m. high, in open forest; corolla white; fruit pale yellow; native name: *lotholotho*); southern slope of Korotini Range, below Navitho Pass, alt. 300–650 m., *Smith 509* (NY) (herb to 2 m. high, on edge of forest; inflorescence 60 cm. long; perianth white; native name: *lotholotho*).

This species has previously been reported only from the type locality on Viti Levu.

Alpinia purpurata (Vieill.) K. Schum. in Pflanzenr. 20 (IV. **46**): 323. 1904.

Kandavu: Namalata Isthmus region, near sea-level, *Smith 8* (GH, NY) (herb, to 2 m. high; bracts bright red; edge of mangrove swamp).

Although this species has been reported from various other Pacific groups, including the Marquesas, Societies, Samoa, Carolines, etc., I believe this to be the first record from Fiji. On Kandavu the species was growing near a village and may have been an escape from cultivation.

ORCHIDACEAE

By L. O. Williams

Habenaria scrotiformis L. O. Williams, sp. nov.

Herbae terrestres graciles usque ad ca. 6 dm. altae. Folia lineari-elliptica acuta vel acuminata. Sepalum dorsale ovato-lanceolatum obtusum. Sepala lateralia ovalia obliqua obtusa. Petala ovato-lanceolata obliqua. Labellum trilobatum tricallosum carnosum; lobis lateralibus linearibus vel lineari-oblongis, incurvatis, obtusis; lobo medio quam lobis lateralibus breviore, subtriangulari, obtuso; calcare scrotiformi.

Slender terrestrial herbs up to about 6 dm. tall. Leaves when mature 6–16 cm. long and 0.8–1.6 cm. broad, linear-elliptic, acute or acuminate, thin, mostly near the middle of the stem, the leaf-sheaths and cauline bracts amplexicaul. Inflorescence a strict, many-flowered, lax spike up to about 25 cm. long; bracts 3–15 mm. long, lanceolate or linear-lanceolate, acute or acuminate, about as long as or exceeding the ovary. Flowers small for the genus, greenish. Dorsal sepal 2–2.5 mm. long and about 1.25 mm. broad, ovate-lanceolate, obtuse, 1-nerved. Lateral sepals 2–2.5 mm. long and 1–1.5 mm. broad, obliquely oval, obtuse, 1-nerved, the

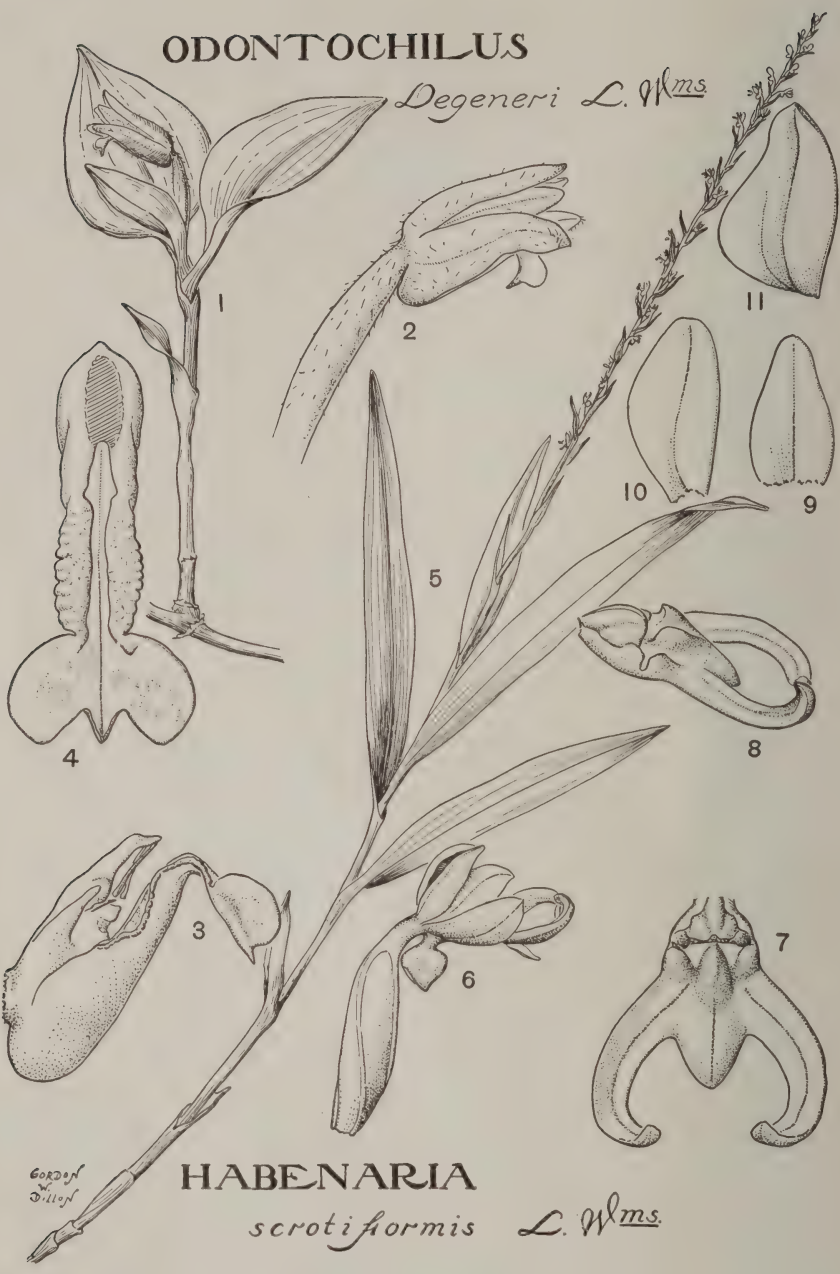

Fig. 1. *1–4. Odontochilus Degeneri; 1.* habit, × 1; *2.* side view of flower, × 2½; *3.* side view of column and lip, × 5; *4.* lip, spread out, × 5. *5–11. Habenaria scrotiformis; 5.* habit, × ½; *6.* side view of flower, × 5; *7.* lip, from above, × 10; *8.* side view of lip, × 10; *9.* dorsal sepal, × 10; *10.* lateral sepal, × 10; *11.* petal, × 10.

base slightly adnate to the lip. Petals 2–2.5 mm. long and 1.5–2 mm. broad, obliquely ovate-lanceolate, obtuse, 2-nerved. Lip about 4 mm. long and about 1.5 mm. broad at base, prominently 3-lobed, with three conspicuous mammillate calluses toward the base, fleshy; lateral lobes linear or linear-oblong, strongly incurved, obtuse; mid-lobe much shorter than the laterals, subtriangular, obtuse; spur about 1.5 mm. long and about 1 mm. in diameter, scrotiform, with a short, small neck.

VANUA LEVU: Thakaundrove: Hills east of Valanga, Savu Savu Bay region, alt. about 100 m., *Degener & Ordonez 13917* (TYPE in Herb. Ames), Dec. 30, 1940 (terrestrial in rich woods).

Habenaria scrotiformis is the smallest flowered species of *Habenaria* known to occur in Oceania. It is allied to *H. physoplectra* Reichb. f., from which it is distinguished by the smaller flowers with slightly different lip and petals and by the narrower leaves.

Odontochilus Degeneri L. O. Williams, sp. nov.

Herbae parvae terrestres usque ad 12 cm. altae. Folia anguste vel late ovata acuta. Sepalum dorsale oblongo-lanceolatum obtusum leviter pubescens. Sepala lateralia sepalo dorsale conformia sed obliqua. Petala lanceolata obtusa undulata leviter obliqua. Labellum basi saccatum angustum cucullatum, apice reniformi-trilobulatum. Columna generis.

Small terrestrial herbs up to about 12 cm. tall. Stems short, weak, probably from a rhizome, the leaves mostly at or above the middle, the upper node usually pubescent. Leaves 1–3 cm. long and 0.8–2.3 cm. broad, narrowly to broadly ovate, acute, extended into a short semiamplexicaul petiole. Inflorescence a 1-few-flowered raceme; bracts up to about 1 cm. long, lanceolate, acute, glabrous or crisped-pubescent. Dorsal sepal about 10 mm. long and 3 mm. broad, narrowly oblong-lanceolate, obtuse, 1-nerved, sparingly pubescent dorsally. Lateral sepals about 11 mm. long and 3.5 mm. broad, narrowly oblong-lanceolate, 1-nerved, somewhat oblique, sparingly pubescent dorsally. Petals about 10 mm. long and 4 mm. broad, lanceolate, obtuse, undulate, somewhat oblique, 1-nerved. Lip about 10 mm. long and about 5 mm. broad at apex, saccate, the terminal portion broadest, reniform-trilobulate, the basal portion saccate at base, with the connecting part narrow, cucullate, fleshy, rugose, the spur 2–4 mm. long. Column of the genus, about 3 mm. long; anther 3–4 mm. long, surpassing the column. Ovary slightly pubescent.

VITI LEVU: Tholo North: Nauwanga, near Nandarivatu, alt. about 750 m., *Degener 14736* (TYPE in Herb. Ames), March 6, 1941 (terrestrial in swampy forest; perianth pure white).

Odontochilus Degeneri seems to be more closely allied to *O. klabatensis* Schltr. from Celebes than it is to the few species of the genus known in the Oceanic Islands. The genera *Odontochilus, Anectochilus* and *Cheirostylis,* all described by Blume, are separated on rather recondite characters, as are some of the other genera of this affinity. It is possible that a generic study of this group will show *Odontochilus* to be the same as *Anectochilus. Odontochilus longiflorus* (Reichb. f.) Benth. & Hook., a Fijian species which I transferred to *Cheirostylis* in 1939, I now believe to be an *Odontochilus.*

Acanthophippium vitiense L. O. Williams (in Am. Orch. Soc. Bull. **10**: 169. 1941) and **Liparis orbiculata** L. O. Williams (l. c. 201) were also based on the Degener Fijian collection. The *Acanthophippium* is of especial interest, extending the known range of the genus eastward from New Guinea.

PIPERACEAE

Piper Timothianum sp. nov.

Frutex ad 3 m. altus, ramis ramulisque ad nodos conspicue incrassatis, ramulis apicem versus gracilibus, teretibus brunneo-strigulosis mox glabris; foliis alternatis, petiolis 8–30 mm. longis fere ad apicem vaginantibus (alis inferne ad 2 mm. latis superne ad petiolum attenuatis) primo brunneo-puberulis mox glabris, laminis siccitate papyraceis fusco-olivaceis ovato-ellipticis, 8–17 cm. longis, 6–12 cm. latis, basi aequaliter rotundatis vel truncatis, apice conspicue cuspidatis vel breviter acuminatis (acumine ad 15 mm. longo obtuso), margine integro, utrinque glabris vel subtus ad nervos basim versus inconspicue cinereo-puberulis, (5–) 7–9-nerviis, nervis e basi divergentibus supra leviter elevatis vel subplanis subtus prominentibus, rete venularum sparso subtus interdum prominulo; inflorescentiis ♀ solis visis in axillis foliorum 3 vel 4 (raro 2) aggregatis, pedunculis gracilibus sub anthesi circiter 5 mm. sub fructu ad 35 mm. longis cum rhachi juventute minute brunneo-strigosis mox glabris, spicis crassis demum ad 7 mm. diametro sub anthesi 8–12 mm. sub fructu 14–35 mm. longis; bracteis liberis peltatis stipitatis, stipite brevi obscure glanduloso-strigoso, pelta submembranacea circiter 0.6 mm. diametro mox evanescente; ovario sessili pyriformi-ellipsoideo post anthesin 3–3.5 mm. longo et apicem versus 1.5–2 mm. diametro, apice rotundato vel demum complanato, stigmatibus 3 vel 4 nigrescentibus sessilibus divaricatis circiter 0.2 mm. longis.

Viti Levu: Tholo North: Nandarivatu, alt. 850 m., *Degener & Ordonez 13570* (A, type), Nov. 22, 1940 (spreading shrub about 1.5 m. high, in rain-forest); Nauwanga, near Nandarivatu, alt. about 750 m., *Degener 14360* (A) (shrub 3 m. high, in dense rich forest; fruiting spikes red, suberect), *Degener 14620* (A) (shrub, in dense forest; native name: *yanggoyanggona*); Nandrau, near Nandarivatu, alt. about 600 m., *Degener 14891* (A).

Piper Timothianum, a member of the Section *Macropiper* C. DC., appears to be closely related only to the common *P. latifolium* Forst., from which it obviously differs in its fewer nerves, its rounded or truncate rather than conspicuously cordate leaf-bases, and its much shorter fruiting spikes. Several species described by De Candolle were based on material from the vicinity of Nandarivatu, but none of them seems closely related to the new species. *Piper polystachyum* C. DC. is the only one of these which suggests *P. Timothianum,* but it differs in its cordate leaf-blades, numerous nerves, semi-vaginate petioles, more numerous and longer spikes, etc.

The specific name, chosen at Mr. Degener's request, commemorates Timoci Bebe (Timothy Mbembe), a Fijian collector whose assistance was of great value during Mr. Degener's work in Tholo North.

Piper Degeneri sp. nov.

Frutex 1 m. altus ubique glaber, ramulis gracilibus teretibus striatis apicem versus 1–2 mm. diametro; stipulis apice ramulorum lanceolatis ad 1 cm. longis; foliis alternatis, petiolis gracilibus 5–10 mm. longis, laminis chartaceis ellipticis, 6–9 cm. longis, 2.5–4.2 cm. latis, basi aequaliter obtusis, apice breviter acuminatis (acumine 5–8 mm. longo obtuso), margine saepe minute recurvatis, pinnatinerviis, costa utrinque paullo elevata, nervis secundariis utrinsecus 2–4 e costa infra medium adscendentibus.utrinque prominulis marginem versus inconspicue conjunctis, rete venularum sparso utrinque leviter prominulo; inflorescentiis ♀ solis visis paucis apice ramulorum oppositifoliis, pedunculis gracilibus 2–4 mm. longis siccitate ut videtur nutantibus, spicis crassis (post anthesin 5–7 mm. diametro) 1–1.5 cm. longis, basi et apice rotundatis; bracteis liberis stipitatis, stipite 1.5–2 mm. longo plerumque 3-angulato apicem versus pilis pallidis circiter 0.3 mm. longis obscure strigoso, pelta submembranacea circiter 1 mm. diametro; ovario sessili pyriformi post anthesin (in specimino nostro) ad 3 mm. longo et 1.5–2 mm.

diametro, summo complanato vel centro leviter depresso, stigmatibus 3–5 nigrescentibus sessilibus radiatis circiter 0.2 mm. longis.

VANUA LEVU: Thakaundrove: East of Naunduna, eastern drainage of Yanawai River, alt. 150 m., *Degener & Ordonez 14096* (A, TYPE), Jan. 12, 1941 (shrub 1 m. high, in dense forest; fruiting inflorescence erect, orange, becoming bright red when ripe).

According to the collectors only one plant of this species was seen; they mention that the spikes were erect, but in the dried specimens they appear somewhat reflexed. *Piper Degeneri* is characterized by its small pinnate-nerved leaf-blades and its very short pistillate spikes with short peduncles. A member of the Section *Eupiper* C. DC., the new species is not closely related to *P. insectifugum* C. DC., the only previously known indigenous Fijian member of this section. According to De Candolle's comprehensive key (in Candollea 1: 67–232. 1923), *P. Degeneri* is most closely allied to *P. corylistachyon* (Miq.) C. DC., a common Philippine species with larger leaves and much longer spikes.

BALANOPSIDACEAE

Trilocularia vitiensis sp. nov.

Arbor ad 10 m. alta ubique glabra, ramulis ut videtur pauciramosis gracilibus juventute viridibus et leviter angulatis demum cinereis et subteretibus; foliis apicem ramulorum versus alternatis, petiolis gracilibus rugulosis 3–12 mm. longis supra canaliculatis, laminis tenuiter coriaceis siccitate olivaceo-viridibus oblongo- vel obovato-ellipticis, 6–12 cm. longis, 2.5–5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice obtusis vel acutis, margine integris saepe undulatis et inconspicue recurvatis, costa supra paullo canaliculata subtus prominente, nervis secundariis utrinsecus 5–8 adscendentibus supra paullo prominulis subtus acute elevatis marginem versus reticulo conjunctis, rete venularum supra subimmerso subtus manifeste prominulo; inflorescentiis ♂ axillaribus vel e ramulis infra vel inter folia orientibus plerumque solitariis, racemosis vel spicatis, stipite inconspicuo incluso 5–13 mm. longis, rhachi gracili (circiter 0.7 mm. diametro) siccitate leviter angulata; floribus 8–15 per inflorescentiam bracteis papyraceis deltoideo-ovatis acutis 1–1.5 mm. longis subtentis, inferioribus pedicellis gracilibus ad 1 mm. longis praeditis, superioribus sessilibus; bracteolis receptaculorum 2 vel 3 membranaceis ovatis acutis 0.5–1 mm. longis et latis, toro inconspicuo; staminibus 3–6, filamentis minutis ad 0.2 mm. longis, antheris oblongo-ellipsoideis, 1.5–2 mm. longis, 1–1.2 mm. latis, basi obscure cordatis, apice minute apiculatis, loculis rimis elongatis lateralibus dehiscentibus; rudimento ovarii nullo; floribus ♀ non visis; fructibus solitariis pedicellatis, pedicellis 12–15 mm. longis superne gradatim incrassatis saepe paullo curvatis; bracteis pedicellorum 6–8 dispersis adpressis chartaceis suborbicularibus, inferioribus circiter 0.5 mm. longis et 1 mm. latis, superioribus ad 2 mm. longis et 3 mm. latis; bracteis involucrantibus circiter 8 imbricatis siccitate subcoriaceis semiorbicularibus vel late ovatis, apice minute cuspidatis vel rotundatis, margine breviter ciliolatis, exterioribus circiter 1.5 mm. longis et 3 mm. latis, interioribus ad 5 mm. longis et 7 mm. latis; fructibus ellipsoideis levibus, 13–15 mm. longis, 9–10 mm. diametro, basi et apice rotundatis, apice stylis plus minusve persistentibus coronatis, pericarpio tenui papyraceo; stylis 3, basi in columnam conspicuam circiter 1.5 mm. diametro connatis, superne liberis et divergentibus, 2–3 mm. longis, fere ad basim bilobatis; seminibus 3 angulatis, dorso convexis, 11–13 mm. longis, circiter 7 mm. latis, testa tenuiter coriacea.

VITI LEVU: Ra: Southwest of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15519* (A) (tree, in forest); Mataimeravula, vicinity of Rewasa, alt. 50–200 m., *Degener 15356* (A, TYPE), May 28, 1941 (tree 10 m. high, in forest; flowers yellow); Tholo North: Vicinity of Nandarivatu, alt. 750–900 m., *Degener 14300* (A) (tree 4 m. high, in open forest along stream; fruit orange); Sovutawambu, near Nandarivatu, alt. 750–900 m., *Degener 14600* (A), (tree, in open forest).

Of the cited collections, numbers *15356* and *15519* bear staminate inflorescences, while *14300* and *14600* are in fruit. This species is one of the most remarkable discoveries of Mr. Degener's recent collection, extending the known range of the Balanopsidaceae from New Caledonia, Queensland, and the New Hebrides to Fiji. It is surprising that the plant has not been obtained by an earlier collector, and one may anticipate finding specimens of it in other parts of herbaria.

Fig. 2. *Trilocularia vitiensis;* *a.* flowering branchlet, × ½; *b.* fruiting branchlet, × ½; *c.* staminate inflorescence, × 2; *d.* staminate flower, × 5; *e.* fruit, × 2.

Trilocularia vitiensis is closely related only to *T. pedicellata* Guillaumin, the single species of the family known from the New Hebrides. From this the new species differs in its more open habit, less congested foliage, and its thinner and larger leaf-blades, which are more obviously nerved and have less sharply recurved margins. As the only known collection of *T. pedicellata* is in fruit, no comparison on the basis of staminate inflorescence is possible. The fruit of the New Hebrides plant appears to have a slightly more rugulose and perhaps thicker pericarp than that of *T. vitiensis.*

MORACEAE

Pseudomorus Brunoniana (Endl.) Bur. in Ann. Sci. Nat. V. **11**: 372. 1869; in DC. Prodr. **17**: 249. 1873; Guillaumin in Jour. Arnold Arb. **13**: 96. 1932.

Viti Levu: Lautoka: North of Lomolomo, alt. 120 m., *Degener & Ordonez 13646* (A) (tree 3 m. high, with many leafy subhorizontal branches, in dry forest of ravine in a small jagged range of hills; flowers whitish; leaves thin-coriaceous, dark green); Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15419* (A) (on dryish forested forehill; native name: *masimasi,* a name usually referred to *Ficus* spp. and perhaps incorrectly used here); Tholo North: Korovou, east of Tavua, alt. 60–150 m., *Degener 14956* (A) (shrub or small tree 2–3 m. high, in isolated dry forested ravine); Nandala, vicinity of Nandarivatu, alt. 750 m., *Degener 14852* (A) (tree 2–3 m. high, in dark rocky forest below cliffs; trunk 3 cm. diam., with dark bark).

It is surprising that a plant with the above altitudinal range has not been previously recorded from Fiji. One may expect to find it among the earlier collections, and in fact, Mr. William Greenwood, according to an unpublished list which he has kindly made available to me, has already obtained it. From the published records which I can locate, the genus, with its single species, is not known to occur between New Caledonia, the New Hebrides, and Micronesia on one hand and Hawaii on the other. Several varieties and subvarieties have been proposed. Whether or not the Hawaiian material is to be left with the Australasian remains to be seen; as to the present collections, they are doubtless conspecific with the New Hebrides specimens known to Guillaumin and also with the type from Norfolk Island.

URTICACEAE

Elatostema J. R. & G. Forst.

Schröter and Winkler (in Rep. Sp. Nov. Beih. **83**(1, 2). 1935, 1936), in their comprehensive and very useful monograph of *Elatostema,* divide the group into four subgenera, *Euelatostema, Pellionia, Elatostematoides,* and *Weddellia.* The first three of these occur in Fiji; the monographic treatment does not include detailed study of *Euelatostema.* Although there are doubtless grounds for C. B. Robinson's separation (in Philip. Jour. Sci. Bot. **5**: 497–501. 1910) of the group into the genera *Elatostema, Pellionia,* and *Elatostematoides,* it seems probable that most students will follow Schröter and Winkler in combining them. This course is followed in the present consideration.

The species of *Elatostema* appear to be very local in distribution. Of the 13 species which I am able to recognize from Fiji, only one, *E. australe* (according to Schröter & Winkl. in Rep. Sp. Nov. Beih. **83**(2): 123. 1936), is found beyond the group. Authentic material of numerous Samoan species has been examined, and when this was not available the descriptions were carefully studied; I conclude that none of the numerous species described from Samoa extend to Fiji. Several of the older species have been widely interpreted and the names of three of them have been recorded in the literature pertaining to Fijian plants.

Gibbs (in Jour. Linn. Soc. Bot. **39**: 171. 1909) lists a specimen from Nandarivatu as representing *E. sessile* J. R. & G. Forst.; this may be either of the species which I describe as *E. palustre* and *E. tenellum,* both of which superficially resemble *E. sessile.* Weddell (in DC. Prodr. **16**(1): 172. 1869) interpreted *E. sessile* very widely. The type collection was from the Society Islands and has been described in a very informative discussion by Setchell (in Univ. Cal. Publ. Bot. **12**: 168. 1926). It has the upper leaf-surface marked with conspicuous linear cystoliths. In the sense of Setchell, *E. sessile* is almost certainly lacking

from Fiji; among the Fijian specimens now available to me, the only one of this relationship is the plant which I describe as *E. palustre,* which differs from *E. sessile* in numerous details of leaf-size, serration, pubescence, etc.

The name *E. macrophyllum* Brongn. has come into the Fijian literature on the basis of a plant collected by Harvey, so determined by Weddell (in DC. Prodr. 16(1): 174. 1869); that specimen is referable to *E. Seemannianum.* A closer relative of *E. macrophyllum* is described in the present treatment as *E. insulare.* The Fijian specimens often determined as *Pellionia elatostemoides* Gaud. are referable to *E. australe.*

Inflorescence characters are difficult to use in *Elatostema,* except in determining the subgenus. Characters pertaining to the pubescence are highly variable and specific lines cannot be drawn satisfactorily by using them. The leaves show a certain degree of stability in their texture, shape, size, and cystolith-markings, and such characters have been freely used in the following key. Some of the species will admittedly need amplification when more complete material from Fiji is available.

Key to the Fijian Species

Inflorescences exinvolucrate; perianth-segments of pistillate flowers obvious, subequal to the ovary or achene.

Perianth-segments not spurred; staminodes present in pistillate flowers; leaf-blades (of Fijian sp.) 11–35 cm. long, (1.5–) 3.5–12.5 cm. broad (§ *Elatostematoides*) ..... 1. *E. australe.*

Perianth-segments dorsally spurred, those of pistillate flowers sometimes with the spurs reduced to mere thickenings; staminodes usually absent; leaf-blades (of Fijian spp.) not exceeding 10 cm. in length and 3 cm. in breadth (§ *Pellionia*).

Leaf-blades elliptic-oblong, 3 or 4 times as long as broad, (1.5–) 3–9 (–10) cm. long, (5–) 8–25 (–30) mm. broad, obtuse to obtusely acuminate at apex, the marginal crenations (4–) 5–15 per side; staminate inflorescence 6–20-flowered, the perianth-segments inconspicuously carinate-spurred ..... 2. *E. vitiense.*

Leaf-blades narrowly oblong, 3–5 times as long as broad, 0.6–2.5 (–3) cm. long, 2–8 mm. broad, obtuse at apex, the marginal crenations 3 or 4 per side; staminate inflorescence 2–10-flowered, the perianth-segments conspicuously corniculate ..... 3. *E. Archboldianum.*

Leaf-blades linear-lanceolate, about 7 times as long as broad, 4–8 cm. long, 5–11 mm. broad, gradually narrowed to an acuminate apex, the marginal crenations 5–10 per side; staminate inflorescence 2–4-flowered, the perianth-segments conspicuously corniculate ..... 4. *E. comptonioides.*

Inflorescences involucrate; perianth-segments of pistillate flowers inconspicuous, minute, much shorter than the ovary or achene. (§ *Euelatostema*).

Leaf-blades without cystoliths on the upper surface, hispid on both surfaces, large (20–40 cm. long, 8–16 cm. broad); receptacles large, 8–22 mm. in diameter; bracteoles 4–7 mm. long ..... 5. *E. nemorosum.*

Leaf-blades with obvious cystoliths on the upper surface.

Cystoliths of the upper leaf-surface linear, straight, not branched, rarely slightly angled.

Coarse or suffruticose herbs, usually more than 1 m. high, the cystoliths of the upper leaf-surface 0.25–0.5 mm. long.

Leaf-blades about twice as long as broad, up to 15 cm. long and 7 cm. broad, the secondary nerves 3–6 per side ..... 6. *E. fruticosum.*

Leaf-blades about 3 times as long as broad, (11–) 15–26 cm. long, (3–) 4–9.5 cm. broad, the secondary nerves 8–12 per side ..... 7. *E. insulare.*

Low herbs, the stems up to 50 cm. high, often subprostrate toward base, the cystoliths of the upper leaf-surface 0.1–0.3 mm. long.

Leaf-blades obovate, 3–6 cm. broad, subsessile, strongly inaequilateral at base, the longer side cordate-subauriculate; receptacles 8–18 mm. in diameter ..... 8. *E. palustre.*

Leaf-blades oblong-lanceolate, less than 2 cm. broad, short-petiolate, attenuate at base; receptacles 2–6 mm. in diameter ..... 13. *E. humile.*

Cystoliths of the upper leaf-surface stellate (3–5-parted) or punctiform, sometimes merely angled, rarely straight and linear.
Coarse herbs, at least 50 cm. high; leaf-blades comparatively large, more than 10 cm. long and 3 cm. broad.
Leaf-blades narrowly obovate-oblong, less than 4.5 cm. broad, 4 or 5 times as long as broad; staminate receptacles 4–5 mm. in diameter .....9. *E. Gillespiei.*
Leaf-blades usually more than 4.5 cm. broad, about 3 times as long as broad; staminate receptacles more than 5 mm. in diameter.
Staminate receptacles 10–35 mm. in diameter; leaf-blades large, (15–) 18–40 cm. long, 6–15 cm. broad, usually subentire toward base ..10. *E. Seemannianum.*
Staminate receptacles 5–9 mm. in diameter; leaf-blades smaller, 10–18 cm. long, (3.5–) 4.5–7 cm. broad, conspicuously serrate at the entire margin 11. *E. eximium.*
Low herbs, up to 50 cm. high, the stem often subprostrate toward base; leaf-blades comparatively small, up to 9.5 cm. long and 2.7 cm. broad.
Leaf-blades 20–27 mm. broad, about 3 times as long as broad, subsessile, often subauriculate on one side at base .....12. *E. tenellum.*
Leaf-blades 8–18 mm. broad, 4 or 5 times as long as broad, short-petiolate, attenuate at base .....13. *E. humile.*

1. **Elatostema** (§ *Elatostematoides*) **australe** (Wedd.) Hall. f. in Ann. Jard. Bot. Buitenz. **13**: 316. 1896; Schröter & Winkl. in Rep. Sp. Nov. Beih. **83**(*2*): 122. *pl. 33.* 1936.

Pellionia elatostemoides sensu Seem. Fl. Vit. 239. 1868; Gibbs in Jour. Linn. Soc. Bot. **39**: 171, 1909; non Gaud.

Pellionia australis Wedd. in DC. Prodr. **16**(1): 169. 1869; Seem. Fl. Vit. 432. 1873.

Pellionia elatostemoides var. *pubescens* Turrill in Jour. Linn. Soc. Bot. **43**: 39. 1915.

Elatostema australe, the only Fijian representative of the subgenus *Elatostematoides,* appears to be the most abundant Fijian *Elatostema.* The type, collected on Ovalau by Vieillard, has the nerves pilose on the lower leaf-surface, as do many of the available specimens. Other specimens, however, have the leaves completely glabrous, and since there is no definite line between these extremes, I doubt if they are worthy of nomenclatural recognition. Some specimens, as e.g. *Smith 83,* have both glabrous and pilose leaves on the same individual. The range of leaf-size is considerable, the length varying from 11–35 cm. and the breadth from (rarely 1.5–) 3.5–12.5 cm. Schröter and Winkler do not account for Turrill's varietal combination, although they cite *im Thurn 286,* the type collection, without comment as *E. australe.* In citing the Fijian material available to me, I arrange it in (1) plants with the lower leaf-surface pilose, at least on the principal nerves, and (2) plants with the leaves completely glabrous.

(1). Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, *Degener 15434* (A); Tholo East: Wainimala River below Matawailevu, *St. John 18256* (A, Bish); Namosi: *Horne 817* (GH); near Namosi, *Gillespie 2522* (A, Bish); Naitasiri: Viria, *Parks 20422* (A, Bish), *Meebold 16662* (Bish). Ovalau: *U. S. Expl. Exped.* (GH, US) (narrow-leaved form). Kandavu: Hills above Namalata and Ngaloa Bays, *Smith 83* (Bish, GH, NY, UC, US) (leaves sometimes glabrous). Without definite locality: *U. S. Expl. Exped.* (GH, US), *Gillespie 2486* (Bish), *2568* (Bish), *2617* (A, Bish).

(2). Viti Levu: Tholo North: Vicinity of Nandarivatu, *Degener 14839* (A); Tholo West: Vicinity of Mbelo, near Vatukarasa, *Degener 15230* (A); Waimbale, near Namboutini, *Degener 15483* (A); Mbuyombuyo, near Namboutini, *Tabulewa 15575* (A); Namosi: *Gillespie 2683* (A, Bish); near Namosi, *Gillespie 2686* (Bish); Voma Mt., *Gillespie 2673* (A, Bish). Kandavu: Mt. Mbuke Levu, *Smith 227* (Bish, GH, NY, UC, US), *280* (Bish, GH, NY, UC, US). Vanua Levu: Thakaundrove: Savu Savu Bay region, *Degener & Ordonez 13864* (A) (narrow-leaved form). Taveuni: Near Waiyevo, *Gillespie 4706* (A, Bish). Without definite locality: *Seemann 429* (GH), *Gillespie 2701* (A, Bish).

The cited specimens, occurring in forest from near sea-level to about 800 m., are reported as shrubs or coarse herbs up to 2 m. high; common native names are

ndraindrai and *mbeta*. The cited U. S. Exploring Expedition sheets are determined in Gray's hand as *Pellionia vitiensis* n. sp., a broad-leaved and a narrow-leaved form being indicated, but these sheets are not to be taken as typifying that species. In describing *Pellionia vitiensis,* Weddell, although he accredited the species to Gray, cited only a Harvey collection, which thus becomes the type. Gray's concept of that species, as represented by the Exploring Expedition sheets, has no nomenclatural status.

2. **Elatostema** (§ *Pellionia*) **vitiense** (Wedd.) comb. nov.

Pellionia vitiensis A. Gray ex Wedd. in DC. Prodr. **16**(1): 167. 1869.

Elatostema filicoides var. *vitiense* Schröter in Rep. Sp. Nov. Beih. **83**(2): 60. 1936.

Viti Levu: Tholo North: *Gillespie,* Nov. 17, 1927 (A, Bish); Nandarivatu, alt. 850 m., *Degener & Ordonez 13560* (A) (subprostrate herb, woody at base, in wet forest; small-leaved form); Tholo West: Mbulu, near Sovi Bay, alt. about 30 m., *Degener 15033* (A) (low shrub to 1 m. high, in wet forest); Yawe, vicinity of Mbelo, near Vatukarasa, alt. 300 m., *Degener 15288* (A) (shrub 1 m. high, in wet forest; small-leaved form with hispid branchlets); Namosi: Vicinity of Namosi, alt. 600 m., *Parks 20212* (Bish) (subligneous herb, in wet forest); Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13754* (A) (subligneous herb, in forest). Kandavu: Mt. Mbuke Levu, alt. 200–500 m., *Smith 245* (Bish, GH, NY, UC, US) (shrub 1–2 m. high, in dense forest; inflorescences white; form with small crowded leaves). Vanua Levu: Thakaundrove: Vicinity of Maravu, near Salt Lake, alt. about 300 m., *Degener & Ordonez 14176* (A) (low shrub, in dark forest); southern slope of Valanga Range, alt. 200–400 m., *Smith 374* (Bish, GH, NY, UC, US) (subligneous herb, in densely forested valley; inflorescence white to pink).

The type of this species was collected by Harvey; the several Exploring Expedition sheets marked in Gray's writing *Pellionia vitiensis* sp. nov. have been discussed under *Elatostema australe.* In view of the fact that Gray had nothing to do with Weddell's description of *Pellionia vitiensis* and even had a different concept in mind for this name, it seems advisable to drop his name from the authorship of the species.

As between this species and the next, I follow Schröter and Winkler in supposing that Harvey's type collection of *Pellionia vitiensis* represents the larger-leaved group. The dimensions of the leaves given by Weddell can fit either species, but he mentions the marginal crenations as 4–6 per side, which would seem to exclude the following species as I interpret it. Schröter and Winkler remark that the Harvey specimen is "schwächliche," referring it to their larger-leaved variety with a question. Furthermore, Harvey collected only at low elevations, and the smaller-leaved species is very probably limited to the mountainous parts of Fiji.

The line between *E. vitiense* and *E. australe* is not clear; on the whole the leaves of the latter are much larger, while the perianth-segments are not spurred and staminodes are apparently always present in pistillate flowers. In the former, the perianth-segments are spurred, but pistillate flowers have the spurs very inconspicuous, often reduced to mere median distal thickenings or occasionally entirely lacking, while staminodes are occasionally found in pistillate flowers. Sometimes, as in *Degener 15033* and *Degener & Ordonez 14176,* staminodes are quite common, some flowers in a head having from one to five, while other flowers lack them. Thus, while the subgenera *Pellionia* and *Elatostematoides* are usually quite separable, we have a case where the line between them breaks down. I believe that the two species may be recognized for convenience; the intermediate forms may be the result of hybridization or they may indicate that the differentiation of a polymorphic species is incomplete.

3. **Elatostema** (§ *Pellionia*) **Archboldianum** sp. nov.

Frutex parvus multiramosus, ramulis gracilibus teretibus glabris vel apicem versus minute et pallide strigosis; stipulis persistentibus binis papyraceis vel submembranaceis brunneis, oblongo-subulatis, 2–5 mm. longis, acuminatis; foliis alternatis, laminis sessilibus (vel petiolis gracilibus ad 0.5 mm. longis) chartaceis anguste oblongis, 6–25 (–30) mm. longis, 2–8 mm. latis, basi inaequilateraliter obtusis vel rotundatis, apice obtusis, margine conspicue crenatis (dentibus obtusis utrinsecus 3 vel 4), supra minute scrobiculatis vel levibus, subtus saepe dispersobrunneo-glandulosis, utrinque cystolithis inconspicuis 0.3–0.6 mm. longis laxe ornatis, costa supra subplana subtus elevata et saepe strigosa, nervis lateralibus utrinsecus 3–7 brevibus obscuris; inflorescentiis ♂ solis visis in nodis solitariis compactis pauciramulosis, pedunculo gracili 2–10 mm. longo glabro vel parce strigoso, floribus 2–10 per inflorescentiam; bracteis membranaceis oblongis acutis, circiter 1.3 mm. longis et 0.6 mm. latis, glabris vel extus paullo strigosis, bracteolis similibus sed minoribus; pedicellis gracilibus sub anthesi 0.3–1.6 mm. longis substrigosis; perianthii segmentis 5 membranaceis elliptico-oblongis, 1.2–2 mm. longis, 0.7–1.6 mm. latis, extus strigoso-puberulis et sub apice calcare conspicuo 0.5–0.7 mm. longo corniculatis; staminibus 5, filamentis gracilibus 1–1.6 mm. longis, antheris oblongis 0.6–1 mm. longis, loculis inferne conspicue divergentibus.

Viti Levu: *Gillespie 2608* (Bish) (native name: *lara*), *3717* (A, Bish); Tholo North: Mt. Matomba, vicinity of Nandarivatu, alt. 750 m., *Degener 14429* (A, TYPE), Feb. 18, 1941 (low shrub, in dense forest); vicinity of Nandarivatu, alt. 750–900 m., *Degener & Ordonez 13559* (A) (erect low shrub less than 1 m. high, in dense wet forest), *Degener 14328* (A) (low shrub, in dark wet forest; flowers white); summit of Mt. Loma Langa, alt. 1200 m., *Gillespie 3912.5* (Bish). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (GH), *Gillespie*, Nov. 12, 1927 (Bish).

The new species probably represents the concept which Schröter and Winkler referred to *E. filicoides* var. *cufilicoides*, a name which, as discussed following my treatment of *Elatostema*, must be excluded from the genus.

Elatostema Archboldianum and *E. vitiense*, as represented by the cited specimens, appear specifically distinct on the basis of the much smaller leaves and more compact staminate inflorescences of the former. Floral differences are scarcely apparent, except for a slight tendency toward more conspicuous spurs on the staminate perianth-segments in *E. Archboldianum*. Doubtless intermediate forms between the two extremes exist, so that the course selected by Schröter and Winkler—of referring them to two varieties of one species—is perhaps justified. However, if this is done, one can hardly fail to include *E. australe* in the same species, since the differences between that species and *E. vitiense* are no greater than those between *E. vitiense* and *E. Archboldianum*. If all are combined, the resultant species will be entirely unwieldy, including plants with leaves varying from 0.6 to 35 cm. in length. In short, in this section of *Elatostema* one must admit that specific lines are arbitrary; those here suggested for the Fijian species are not sharp, but they seem to serve on the basis of present material.

4. **Elatostema** (§ *Pellionia*) **comptonioides** sp. nov.

Frutex gracilis 0.5–2 m. altus, ramulis subteretibus vel apicem versus leviter sulcatis dense strigoso-puberulis demum glabratis; stipulis persistentibus binis papyraceis castaneis subulato-lanceolatis, 4–9 mm. longis, glabris vel dorso obscure strigosis; foliis apicem ramulorum versus confertis alternatis, petiolis subnullis vel ad 1 mm. longis et breviter strigosis, laminis chartaceis lineari-lanceolatis, 4–8 cm. longis, 5–11 mm. latis, basi inaequilateraliter obtusis vel rotundatis, apicem versus gradatim angustatis et apice obtuse acuminatis, margine profunde crenatis (dentibus utrinsecus 5–10), utrinque cystolithis 0.25–0.4 mm. longis conspicue ornatis, costa supra subplana subtus elevata et pallido-strigosa, nervis lateralibus

numerosis brevibus obscuris interdum strigosis; inflorescentiis ♂ solis visis paucis in nodis solitariis subcapitatis, pedunculo gracili 6–12 mm. longo parce strigoso, floribus 2–4 per inflorescentiam subsessilibus; bracteis membranaceis acutis oblongis, 1.3–1.8 mm. longis, circiter 0.5 mm. latis, glabris vel extus parce strigosis, bracteolis similibus sed minoribus; perianthii segmentis 5 membranaceis ellipticooblongis, circiter 1.3 mm. longis et 1 mm. latis, extus parce strigosis, apice obtusis, dorso apicem versus calcare conspicuo 0.5–0.8 mm. longo corniculatis; staminibus 5, filamentis gracilibus circiter 1 mm. longis, antheris oblongis circiter 0.8 mm. longis, loculis inferne conspicue divergentibus.

Vanua Levu: Thakaundrove: Natewa Peninsula, Uluingala, alt. 600–820 m., *Smith 1977* (Bish, GH, type, NY, UC, US), June 15, 1934 (shrub 0.5–2 m. high, in dense forest; inflorescence white).

Elatostema comptonioides seems amply distinguished from its relatives in § *Pellionia* by the foliage-characters mentioned in the key. The leaves of the new species bear a remarkable superficial similarity to those of *Comptonia peregrina* (L.) Coult.

5. **Elatostema** (§ *Euelatostema*) **nemorosum** Seem. Fl. Vit. 240. *pl. 61.* 1868.

Coarse herb up to 2 m. high, the stem simple, sparsely hispid, glabrescent; leaves alternate, subsessile, the blades papyraceous, brownish when dried, slightly paler beneath, subfalcate-obovate, 20–40 cm. long, (6–) 8–16 cm. broad, gradually narrowed toward base and strongly inequilateral (one side attenuate, the other cordate-subauriculate), abruptly short-acuminate at apex, coarsely serrate at margin (teeth 2–4 per centimeter, subacute, 2–5 mm. long), minutely scrobiculate and hispid above with pale hairs 1–2 mm. long, more densely hispid or crispate-hispid beneath (especially on nerves) with slightly shorter hairs, the cystoliths none on either surface, the costa stout, slightly raised above and subprominent beneath, the secondary nerves 10–17 per side, erecto-patent, subplane or slightly raised above, elevated beneath, the veinlet-reticulation immersed above, slightly prominulous beneath; stipules papyraceous or submembranous, oblong-linear, 2–5 cm. long, dorsally short-hispid; staminate receptacles 17–22 mm. in diameter, on slender hispidulous or glabrescent peduncles up to 1 cm. long, the outer bracts chartaceous, subreniform, up to 14 mm. long and 24 mm. broad, sericeo-hispidulous, glabrescent, carinate or obscurely corniculate dorsally toward apex, the inner bracts similar but smaller; bracteoles membranous, oblong-obovate, 5–7 mm. long, 2–4 mm. broad, obscurely hispidulous distally without; pedicels slender, to 1 mm. long; perianth-segments 4, membranous, lanceolate, 1–1.6 mm. long, acute and sparsely hispid-ciliate at apex; anthers about 0.4 mm. long; pistillate receptacles pedunculate like the staminate, 8–20 mm. in diameter, the outer bracts usually several, connate at base, oblong, 5–7 mm. long, carinate dorsally and acute at apex, sparsely hispidulous, the inner bracts gradually smaller; bracteoles membranous, linear 4–6 mm. long, 0.4–1 mm. broad, distally hispidulous; pedicels to 4 mm. long; perianth-segments inconspicuous, the achene ovoid, about 1 mm. long.

Viti Levu: Tholo North: Nandarivatu, alt. 1200 m., *Parks 20788* (A, Bish) (coarse herb 1 m. high, in wet canyons); Nandrau, near Nandarivatu, alt. 600 m., *Degener 14887* (A) (native name: *mbeta*); Namosi: Namosi, alt. 600–900 m., *Parks 20273* (A, Bish) (herb, more than 1 m. high, in dense wet forest). Vanua Levu: Thakaundrove: Mt. Mariko, alt. 600–866 m., *Smith 464* (Bish, NY, US) (coarse herb 2 m. high, in dense forest; heads greenish). Taveuni: *Seemann 422* (GH, type coll.); trail from Somosomo, alt. 950 m., *Gillespie 4824* (A, Bish) (in dark wet canyon).

As represented by the cited specimens, *E. nemorosum,* which is apparently limited to higher elevations, is a very well-marked and easily recognized species. Probably the following specimen also belongs here: *Meebold 16661* (Bish), from

Mt. Korombamba, Naitasiri, Viti Levu. However, this specimen has slightly smaller leaves than those above described, the stiff hairs of the upper surface are few or lacking, the hairs of the nerves beneath are subappressed rather than spreading, short linear cystoliths are often visible on the lower surface, and the bracts and bractoles of staminate heads are minutely glandular. In view of the variation which is evident in many species of *Elatostema*, I doubt if these characters denote a departure of nomenclatural value, but further material is desirable.

6. **Elatostema** (§ *Euelatostema*) **fruticosum** Gibbs in Jour. Linn. Soc. Bot. **39**: 171. *pl. 16.* 1909.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 800–1200 m., *Degener & Ordonez 13522* (A) (coarse subligneous herb about 2 m. high, in dark wet forest; stems succulent; leaves dark green; inflorescence whitish), *Parks 20543* (A, Bish) (herb 50 cm. high, in forest).

The cited specimens, from the type locality, agree excellently with the original description and plate. Our specimens have the leaf-blades up to 15 cm. long and 7 cm. broad and the secondary nerves are often 5 or 6 per side. The species is only remotely related to *E. sessile* Forst.

7. **Elatostema** (§ *Euelatostema*) **insulare** sp. nov.

Herba ad 2 m. alta pauciramosa, ramulis substrigosis vel glabris; foliis alternatis, petiolis strigosis vel glabris 1–10 mm. longis, laminis papyraceis siccitate fusco-viridibus vel olivaceis, subtus pallidioribus, inaequilateraliter ellipticooblongis, (11–) 15–26 cm. longis, (3–) 4–9.5 cm. latis, basi subacutis vel latere breviore obtusis, apice gradatim caudato-acuminatis, margine dentibus 1 vel 2 per centimetrum grosse crenatis vel undulatis, supra cystolithis linearibus 0.25–0.5 mm. longis conspicue ornatis et glabris vel pilis pallidis circiter 1 mm. longis parce strigosis, subtus pilis 0.5–1 mm. longis praecipue ad nervos hispido-strigosis vel glabris et interdum cystolithis (nervis solis) ornatis, pinnatinerviis, costa supra leviter elevata subtus prominente, nervis lateralibus utrinsecus 8–12 adscendentibus supra paullo subtus conspicue elevatis, venulis obscuris vel subtus prominulis; stipulis papyraceis vel membranaceis lineari-oblongis 1.5–4 cm. longis dorso strigosis caducis; receptaculis subsessilibus vel breviter pedunculatis, pedunculis ad 5 mm. longis puberulis glabratis; receptaculis ♂ 6–22 mm. diametro, bracteis exterioribus saepe subcarnosis in pelta suborbiculari connatis, extus minute strigosis vel glabris et interdum parce brunneo-glandulosis, apicem versus inconspicue carinato-corniculatis, bracteis interioribus papyraceis vel submembranaceis minoribus; bracteolis membranaceis oblongo-spathulatis, 3–4 mm. longis, 1.5–2 mm. latis, apicem versus obscure pilosis; pedicellis ad 1 mm. longis, perianthii segmentis 4 circiter 1 mm. longis, antheris oblongis circiter 0.8 mm. longis; receptaculis ♀ 7–8 mm. diametro, bracteis numerosis papyraceis anguste oblongis, 4–5 mm. longis, basi connatis, dorso strigosis, apice carinato-corniculatis, interioribus angustioribus; bracteolis 2–3 mm. longis et 0.4–0.7 mm. latis, apicem versus strigosis, saepe obscure corniculatis; pedicellis ad 1 mm. longis, perianthii segmentis minutis, achenio anguste ellipsoideo circiter 0.5 mm. longo.

Koro: Eastern slope of main ridge, alt. 300–500 m., *Smith 1064* (Bish, NY) (herb to 1 m. high, in forest). Kandavu: Mt. Mbuke Levu, alt. 200–500 m., *Smith 238* (Bish, GH, NY, UC, US) (coarse herb 1–2 m. high, in dense forest; heads whitish). Vanua Levu: Thakaundrove: Vatunivuamonde Mt., Savu Savu Bay region, alt. 250 m., *Degener & Ordonez 14004* (A) (subligneous herb, in dark forest). Taveuni: Vicinity of Waiyevo, alt. 400 m., *Gillespie 4727* (A, type, Bish), Feb. 27, 1928 (in dark wet stream bed in woods above coconut plantations).

A represented by the four cited collections, the species shows some variation, but I believe that the material is conspecific. The lower leaf-surface is usually strigose, but *Smith 238* has the leaves quite glabrous; the margin is generally

crenate, but the Gillespie specimen has the crenations very inconspicuous. Pistillate inflorescences are found on *Degener & Ordonez 14004,* the others bearing staminate heads.

The new species is suggestive of *E. macrophyllum* Brongn. (Bot. Voy. Coquille 207. *pl. 45.* 1834), based on a specimen from Amboina. Our plant differs from that, however, in its longer cystoliths, which are practically lacking from the lower leaf-surfaces, and in details of its staminate inflorescence, such as the perianth-segments being obtuse rather than acuminate at apex. A closer relative of *E. insulare* is *E. fruticosum,* which differs from it as noted in the key.

8. **Elatostema** (§ *Euelatostema*) **palustre** sp. nov.

Herba ad 50 cm. alta, caule inferne subprostrato superne suberecto ut videtur succulento glabro; foliis alternatis, laminis subsessilibus tenuiter papyraceis siccitate viridibus inaequilateraliter obovatis, 8–16 cm. longis, 3–6 cm. latis, basim versus gradatim angustatis et valde inaequilateralibus (uno latere attenuatis, altero cordato-subauriculatis), apice acutis vel breviter acuminatis, margine dentibus subacutis 3–5 mm. longis 2 vel 3 per centimetrum grosse serratis, utrinque cystolithis linearibus 0.15–0.2 mm. longis inconspicue ornatis, supra pilis pallidis 1–2 mm. longis et subtus pilis paullo minoribus praecipue ad nervos hispidis, pinnatinerviis, costa supra subplana subtus prominente, nervis lateralibus utrinsecus 7–9 adscendentibus supra planis subtus leviter elevatis, rete venularum subtus paullo prominulo; stipulis membranaceis anguste ellipticis 1.5–2 mm. longis dorso hispido-strigosis; receptaculorum pedunculis gracilibus 4–13 mm. longis obscure strigosis glabratis; receptaculis ♂ 10–18 mm. diametro, bracteis exterioribus papyraceis reniformibus, circiter 7 mm. longis et 12 mm. latis, extus pallido-strigillosis et cystolithis linearibus minutis circiter 0.1 mm. longis copiose ornatis, apicem versus breviter carinato-corniculatis, bracteis interioribus similibus sed minoribus; bracteolis membranaceis obovato-oblongis, 2.5–4 mm. longis, 1–2 mm. latis, dorso parce strigosis; pedicellis ad 1 mm. longis, perianthii segmentis 4 acutis 1.5–2 mm. longis, antheris oblongis circiter 1.5 mm. longis; receptaculis ♀ 8–10 mm. diametro, bracteis submembranaceis numerosis deltoideo-oblongis, circiter 5 mm. longis, basi connatis, margine hispido-ciliatis, dorso apicem versus carinato-corniculatis, exterioribus 3–4 mm. latis, interioribus angustioribus; bracteolis lineari-spathulatis, 2.5–3 mm. longis, 0.2–0.5 mm. latis, apicem versus strigosis; pedicellis ad 2 mm. longis, perianthii segmentis minutis, achenio anguste ellipsoideo circiter 0.8 mm. longo.

Viti Levu: Tholo East: Central plateau between Wainimala and Singatoka Rivers, Wainisavulevu-Numbololo divide, Taunaisali, alt. 1150 m., *St. John 18337* (A, type, Bish), Aug. 18, 1937 (in swampy rain-forest; native name: *mbeta*).

The new species is of the relationship of the Samoan *E. cupreo-viride* Rechinger, from which it differs in its much larger stipules, its larger and proportionately narrower leaf-blades with narrower base and more numerous serrations, and its hispid rather than appressed-pilose nerves of the lower leaf-surface.

9. **Elatostema** (§ *Euelatostema*) **Gillespiei** sp. nov.

Herba succulenta vel basim versus forsan sublignosa, caule gracili glabro conspicue nodoso; foliis alternatis, petiolis leviter canaliculatis 2–7 mm. longis glabris, laminis papyraceis siccitate flavo-viridibus utrinque glabris anguste et leviter inaequilateraliter obovato-oblongis, 14–20 cm. longis, 3–4.5 cm. latis, basi gradatim angustatis et acutis vel latere breviore obtusis, apice conspicue caudato-acuminatis, margine inferne integris superne inconspicue undulato-crenatis (dentibus 1 vel 2 per centimetrum), utrinque cystolithis stellatis 3–5-ramulosis circiter 0.15 mm. diametro densissime papillosis, pinnatinerviis, costa supra leviter elevata subtus prominente, nervis lateralibus utrinsecus 7–11 valde adscendentibus supra planis

subtus elevatis, rete venularum supra immerso subtus plano; stipulis papyraceis glabris lineari-oblongis 2–2.5 cm. longis; receptaculis breviter pedunculatis, pedunculo 1–3 mm. longo glabro; receptaculis ♂ 4–5 mm. diametro, bracteis exterioribus subcoriaceis connatis, extus strigoso-puberulis glabratis, apicem versus carinato-corniculatis, bracteis interioribus papyraceis minoribus; bracteolis membranaceis obovatis, 2–3 mm. longis, 1–1.5 mm. latis, apicem versus puberulis; pedicellis ad 0.5 mm. longis, perianthii segmentis 4 circiter 0.8 mm. longis, antheris oblongis minutis; receptaculis ♀ 6–8 mm. diametro, bracteis numerosis papyraceis 3–4 mm. longis glabratis, basi connatis, apicem versus obscure carinatis; bracteolis lineari-obovatis, circiter 2 mm. longis, 0.3–0.6 mm. latis, apicem versus hispidulis; pedicellis ad 0.7 mm. longis, perianthii segmentis 4 lanceolatis minutis, stylis circiter 1 mm. longis, achenio obovoideo-ellipsoideo ad 1 mm. longo.

Viti Levu: Naitasiri: Korombamba Mt., near summit, alt. 500 m., *Gillespie 2402* (A, type, Bish), Aug. 24, 1927.

Elatostema Gillespiei is clearly related to *E. Seemannianum*, which it resembles in leaf-texture and cystolith-marking, but from which it differs in its much narrower leaf-blades with sharply ascending veins and in its substantially smaller inflorescences. Another collection which is probably referable to *E. Gillespiei* is *Parks 20055* (A, Bish), from Lami, alt. 100 m., near Suva, Rewa, Viti Levu. This specimen differs from the type only in its smaller leaf-blades (7–14 cm. long, 2–4 cm. broad), which are more obviously crenate at margins and hispid on the nerves beneath, and in its more obviously pubescent staminate heads. Characters of pubescence and leaf-margins are of such dubious value in *Elatostema* that I believe the Parks plant may be safely referred here.

10. **Elatostema** (§ *Euelatostema*) **Seemannianum** A. C. Sm. in Bishop Mus. Bull. **141**: 58. *f. 27.* 1936.

Elatostema macrophyllum sensu Seem. Fl. Vit. 241, excl. syn. 1868; Gibbs in Jour. Linn. Soc. Bot. **39**: 172. 1909; non Brongn.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 600–925 m., *Gillespie 4256* (A, Bish) (on banks of small stream), *Degener & Ordonez 13600* (A) (coarse herb less than 1 m. high, in forest; staminate heads whitish), *Degener 14923* (A) (in forest; native name: *mbeta*); Tholo West: Waimbale, near Namboutini, *Degener 15470* (A) (coarse herb, on partly forested slope; native name: *mbeta*); Naitasiri: Viria, *Meebold 16431* (Bish). Ovalau: *U. S. Expl. Exped.* (GH, US), *Bryan 610* (Bish) (succulent herb to 2 m. high, on stream-bank in rain-forest at 150 m. alt.; receptacle green; staminate flowers white). Koro: Eastern slope of main ridge, alt. 300–500 m., *Smith 982* (Bish, type, NY) (herb to 2 m. high, in forest; anthers white). Without definite locality: *Harvey* (GH).

This well-marked species has large leaf-blades which remain yellowish green when dried and which appear to have the upper surfaces closely papillose. Closer observation shows that the punctiform papillae are minute stellate 3–5-branched cystoliths. The species is not a close relative of *E. macrophyllum* Brongn.

11. **Elatostema** (§ *Euelatostema*) **eximium** sp. nov.

Herba succulenta ut videtur ad 50 cm. alta, caule fusco apicem versus dense brunneo-strigoso demum glabrato; foliis alternatis, petiolis subnullis vel ad 4 mm. longis ut caule strigosis, laminis papyraceis siccitate fusco- vel flavo-viridibus inaequilateraliter obovatis, 10–18 cm. longis, 3.5–7 cm. latis, basi gradatim angustatis et acutis vel latere longiore obtusis, apice abrupte et gracile acuminatis, margine omnino dentibus subacutis 2 vel 3 per centimetrum conspicue serratis, utrinque cystolithis stellatis 3- vel 4-ramulosis 0.13–0.3 mm. diametro (raro tantummodo angulatis) manifeste ornatis, supra glabris vel pilis paucis ad 1 mm. longis disperse strigosis, subtus ad nervos dense strigosis, pinnatinerviis, costa supra subplana subtus prominente, nervis lateralibus utrinsecus 8–12 arcuato-adscendentibus supra planis subtus elevatis, venulis immersis vel subtus prominulis; stipulis papy-

raceis bicarinatis dorso hispidulis glabratis lineari-oblongis 1.5–3 cm. longis; receptaculis ♂ solis visis 5–9 mm. diametro subsessilibus vel breviter pedunculatis, pedunculo crasso ad 2 mm. longo strigoso-puberulo; bracteis exterioribus papyraceis reniformibus, circiter 6 mm. longis et 8 mm. latis, connatis, extus strigoso-puberulis et minute brunneo-glandulosis, plerumque conspicue corniculatis, bracteis interioribus similibus sed minoribus; bracteolis membranaceis obovato-spathulatis, 3–5 mm. longis, 1–4 mm. latis, dense brunneo-glanduloso-lineolatis, extus apicem versus pallido-strigosis; pedicellis ad 2 mm. longis, perianthii segmentis 4 membranaceis obovatis, 2–2.5 mm. longis, glanduloso-lineolatis, exterioribus calcaribus 0.3–0.5 mm. longis apicem versus corniculatis, filamentis 1–1.5 mm. longis, antheris oblongis 1–1.2 mm. longis.

Viti Levu: Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15578* (A, type), June 17, 1941 (inflorescence red; native name: *mbeta*). Ovalau: *U. S. Expl. Exped.* (GH) (alt. 450 m.).

This well-marked species is distinguished not only by the leaf-characters mentioned in the key, but also by the glandular-lineolate bracteoles and staminate perianth-segments, the latter being corniculate and comparatively large.

12. **Elatostema** (§ *Euelatostema*) **tenellum** sp. nov.

Herba, caule basim versus prostrato et radicoso superne suberecto ad 50 cm. alto, apicem versus minute strigoso demum glabro; foliis alternatis, petiolis subnullis, laminis papyraceis siccitate viridibus inaequilateraliter obovato-oblongis, 5–9 cm. longis, 2–2.7 cm. latis, basi latere breviore acutis latere longiore saepe cordato-subauriculatis, apice gradatim acuminatis, margine omnino dentibus acutis 2 vel 3 per centimetrum grosse serratis, supra cystolithis stellatis 3–5 ramulosis (raro tantummodo angulatis vel linearibus) 0.08–0.25 mm. diametro inconspicue ornatis, subtus cystolithis similibus paucioribus praeditis, supra glabris vel pilis 0.3–0.7 mm. longis disperse strigosis, subtus nervis pilis ad 1 mm. longis dense strigosis, pinnatinerviis, costa supra subplana subtus elevata, nervis lateralibus utrinsecus 6–8 arcuato-adscendentibus supra planis subtus valde prominulis, venulis subimmersis; stipulis papyraceis linearibus 7–10 mm. longis dorso setulosis mox glabris; receptaculis ♀ solis visis subsessilibus 2–5 mm. diametro, bracteis numerosis in pelta suborbiculari papyracea connatis strigoso-puberulis glabratis, apice liberis et acutis, apicem versus obscure glanduloso-lineolatis; bracteolis membranaceis oblongo-lanceolatis, 1–1.5 mm. longis, 0.15–0.3 mm. latis, apicem versus strigosis; pedicellis ad 0.5 mm. longis, perianthii segmentis 3 vel 4 minutis ad 0.2 mm. longis, achenio ovoideo-ellipsoideo ad 0.8 mm. longo.

Viti Levu: Namosi: Trail to Namosi, alt. 600 m., *Parks 20209* (A, Bish) (herb, to 50 cm. high, in wet forest). Vanua Levu: Thakaundrove: Mt. Mariko, alt. 600–866 m., *Smith 471* (Bish, GH, type, NY, UC, US), Nov. 14, 1933 (subprostrate herb, in dense undergrowth of forest).

Both the specimens bear only pistillate inflorescences. *Elatostema tenellum* is characterized by its subprostrate habit, subsessile leaf-blades, large marginal serrations, and small inflorescences. Although it bears a superficial resemblance to *E. sessile* J. R. & G. Forst., its only close allies appear to be *E. eximium* and *E. humile*.

13. **Elatostema** (§ *Euelatostema*) **humile** sp. nov.

Herba ad 40 cm. alta, caule ut videtur suberecto glabro vel apicem versus obscure strigoso; foliis alternatis, petiolis gracilibus ad 4 mm. longis mox glabris, laminis papyraceis siccitate viridibus vel subfuscis oblongo-lanceolatis, 4–9.5 cm. longis, 8–18 mm. latis, basi inaequilateraliter attenuatis, apice gradatim acuminatis, margine dentibus subacutis 1–3 per centimetrum conspicue serratis, supra cystolithis interdum 3- vel 4-partitis 0.15–0.25 mm. diametro interdum angulatis vel linearibus 0.1–0.3 mm. longis manifeste ornatis, subtus cystolithis similibus inconspicue

praeditis vel nervis dense ornatis, supra glabris, subtus glabris vel nervis pilis 0.4–0.7 mm. longis strigosis, pinnatinerviis, costa supra leviter prominula vel insculpta subtus elevata, nervis lateralibus utrinsecus 5–7 valde adscendentibus supra planis subtus prominulis, venulis obscuris; stipulis submembranaceis lanceolatis 7–10 mm. longis dorso sericeis mox glabris; receptaculis subsessilibus vel breviter pedunculatis, pedunculo ad 1.5 mm. longo strigoso-puberulo vel glabro; receptaculis ♂ 3–6 mm. diametro, bracteis exterioribus papyraceis late ovatis, 4–5 mm. longis, basi connatis, extus breviter strigosis, apicem versus breviter corniculatis, bracteis interioribus minoribus; bracteolis membranaceis oblongo-obovatis, 3–4 mm. longis, 1–2 mm. latis, obscure glanduloso-lineolatis, dorso parce strigillosis; pedicellis ad 1 mm. longis, perianthii segmentis 4 oblongis circiter 2 mm. longis, apicem versus calcare circiter 0.3 mm. longo plerumque corniculatis, antheris oblongis circiter 1 mm. longis; receptaculis ♀ 2–4 mm. diametro, bracteis numerosis submembranaceis lineari-oblongis connatis, apicem versus strigosis liberis obscure corniculatis; bracteolis membranaceis linearibus, 1–1.4 mm. longis, 0.1–0.15 mm. latis, dense strigosis; pedicellis brevissimis, perianthii segmentis obscuris, achenio ellipsoideo ad 0.8 mm. longo.

Viti Levu: Naitasiri: Korombamba Mt., near summit, alt. 500 m., *Gillespie 2403* (Bish). Taveuni: Vicinity of Waiyevo, alt. 650 m., *Gillespie 4731.5* (A, type, Bish), Feb. 27, 1928 (in moist stream-beds in woods above coconut plantations).

Of the two cited specimens, the type collection bears pistillate heads and no. *2403* staminate. The two plants are not exactly similar, the type being essentially glabrous throughout, while the other has a strigose pubescence on the stem, lower surface of leaves, etc. Cystoliths of no. *4731.5* are predominantly of the short linear type while no. *2403* has them commonly stellate, but intermediate forms are found on both specimens. It is possible that additional material will indicate that the two are not conspecific, but I believe it more likely, in view of their great similarity in leaf-shape, texture, etc., that future collections will disclose intermediate forms.

Excluded Species

Pellionia filicoides Seem. Fl. Vit. 239. 1868; Wedd. in DC. Prodr. **16**(1): 168. 1869.

Elatostema filicoides Seem. in Bonplandia **9**: 259, nomen. 1861; Schröter & Winkl. in Rep. Sp. Nov. Beih. **83**(2): 59, *quoad typum*. 1936.

Elatostema filicoides var. *eufilicoides* Schröter in Rep. Sp. Nov. Beih. **83**(2): 59, *quoad typum*. 1936.

Viti Levu: Serua: Navua River, *Seemann 421* (GH, type coll.).

In proposing *P. filicoides* in Flora Vitiensis, Seemann cites his no. *421* and also collections by Williams and Harvey, but it is obvious that he considered his own collection the type, since his first combination *Elatostema filicoides* was based entirely upon it. *Seemann 421* bears a remarkable superficial resemblance to a *Pellionia*, but closer examination shows that the supposed "leaves" lack cystoliths and have a closed fern-like venation and that the "hairs" of the "branchlets" and costas are actually narrow scales. The type collection represents a sterile frond of the fern **Lomagramma polyphylla** Brack. (1854) and the above cited names should be removed to the synonymy of this fern, even though the descriptions cited are, for the most part, of plants properly referred to *Pellionia* or *Elatostema*.

Elatostema peltatum Hemsl. in Kew Bull. **1901**: 143. 1901.

In order properly to place this species, one must see the type collection, made on Vanua Levu by Horne. From the description, it seems unlikely that a species of *Elatostema* is represented; at least, no Fijian species with peltate leaves or with a petiole 1.5–2 inches long is known to me.

Procris Commers.

In her monograph of the genus *Procris,* Hilde Schröter (in Rep. Sp. Nov. **45**: 179–192, 257–300. 1938) lists Fijian specimens as representing only *P. pedunculata* (J. R. & G. Forst.) Wedd. var. *eupedunculata* Schröter, this being, in fact, the only form which she mentions from the Pacific east of the Solomons and Micronesia. Among the Fijian collections available to me, it is obvious that several species are represented, three of them belonging to the group with pedunculate pistillate inflorescences (of these, two were erroneously referred by me in 1936 to the genera *Elatostema* and *Pellionia*). In this group Schröter recognizes only one species, *P. Wightiana* Wall., with a range from Africa to the Philippines and the Bonin Islands. Since most of the material of this genus belonging to American herbaria is still on loan and therefore not available, I cannot check the specific lines as proposed in the recent monograph. For the purpose of naming the Fijian specimens, I depend upon the monograph and the numerous specimens which are still available in the Gray Herbarium.

Key to the Fijian Species

Pistillate inflorescence sessile .....1. *P. pedunculata.*
Pistillate inflorescences obviously pedunculate.
Cystoliths of the leaf-blades inconspicuous, very few and scattered on upper surface, absent from lower surface; leaf-blades obscurely pellucid-punctate, the glands copious, often faintly depressed above, pale and crowded beneath. .....2. *P. anfracta.*
Cystoliths of the leaf-blades obvious on both surfaces.
Leaf-blades 4–8 cm. long, thick, not pellucid-punctate, the glands often depressed above, obscure beneath; cystoliths 0.1–0.25 mm. long, those of upper surface 8–12 per sq. mm., those of lower surface 35–50 per sq. mm. .....3. *P. Archboldiana.*
Leaf-blades (8–) 10–20 cm. long, minutely scrobiculate on upper surface, the lower surface often with superficial minute brown scattered glands; cystoliths 0.2–0.5 mm. long, those of upper surface 4–12 per sq. mm., those of lower surface 5–14 per sq. mm. .....4. *P. Goepeliana.*

1. **Procris pedunculata** (J. R. & G. Forst.) Wedd. in DC. Prodr. **16**(1): 191. 1869; Schröter in Rep. Sp. Nov. **45**: 259. 1938.

Elatostema pedunculatum J. R. & G. Forst. Char. Gen. 106. 1776.

I have not sufficient material available to test Schröter's concept of *P. pedunculata,* but on the surface this seems very broad indeed. An examination of adequate material of this group from the Societies, the type locality, discloses that the leaf-blades are usually pellucid-punctate (at least obscurely so) and have the cystoliths on both surfaces comparatively scattered in comparison with those of the bulk of the Fijian material. The different aspects of the leaves caused by the different spacing of the cystoliths is striking, although it is rather unsatisfactorily expressed in words. While this may not be a character worthy of specific recognition, I believe that it will serve at least to mark varieties; it seems likely that Schröter's variety *eupedunculata* (based on the type of the species) should be more narrowly limited and that some of the specific names submerged by her should be given at least varietal recognition. Possibly the typical variety will be found limited to the Pacific; some of the Fijian material certainly is essentially identical with that from the Societies, Samoa, etc. On the basis of the specimens at hand I am inclined to doubt whether the bulk of the Malaysian and African material should be left in the variety *eupedunculata,* if indeed in the species at all. The form with very crowded cystoliths seems limited to Fiji and Tonga and may well be recognized as a variety. Thus, in our region, one may readily distinguish two varieties of *P. pedunculata* as follows:

Leaf-blades often pellucid-punctate or at least with obvious glands which are often depressed on the upper surface; cystoliths of the upper leaf-surface 0.13–0.25 mm. long, 8–20 per sq. mm., those of the lower leaf-surface 0.2–0.5 mm. long, 5–17 per sq. mm. ..... var. *eupedunculata*.

Leaf-blades thicker, not pellucid-punctate, the glands obscure; cystoliths of the upper leaf-surface 0.13–0.6 mm. long, 18–45 per sq. mm., those of the lower leaf-surface 0.16–0.7 mm. long, 12–35 per. sq. mm. ..... var. *ornata*.

Var. **eupedunculata** Schröter in Rep. Sp. Nov. **45**: 260. 1938, *quoad Elatostema pedunculatum* J. R. & G. Forst.

KORO: West coast, near sea-level, *Smith 1076* (GH). VANUA MBALAVU: Southern limestone section, alt. 0–100 m., *Smith 1441* (GH). FULANGA: Limestone formation, on cliff, alt. 0–80 m., *Smith 1140* (GH).

Some of the other Fijian specimens cited by Schröter (l. c. 264, 265) may belong in this concept, but they are not now available to me for examination. This variety seems less common in Fiji than the following.

Var. **ornata** var. nov.

Frutex parvus vel herba succulenta var. *eupedunculata* Schröter affinis, laminis foliorum crassioribus non pellucido-punctatis, cystolithis conspicue confertioribus ornatis differt.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, alt. 750–1000 m., *Gillespie 4297* (A, Bish) (growing on rocks in stream), *Parks 20648* (A, Bish) (low epiphytic shrub; heads red), *Degener 14848* (A) (low shrub, on wet rocks in forest); Nauwanga, near Nandarivatu, alt. 750–900 m., *Degener 14509* (A) (subligneous herb, in forest; fruiting receptacle orange; flowers white), *Degener 14826* (A, TYPE), Mar. 13, 1941 (low shrub, on wet rocks in forest; receptacle red); summit of Loma Langa Mt., alt. 1300 m., *Gillespie 3926.5* (Bish); Nasukamai, alt. 450 m., *Gillespie 4393* (Bish) (on rocks of river-bank; native name: *kau tho*); Ra: Vatundamu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15402* (A) (on rocks in dry forest; native name: *tokai*); Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15573* (A); Namosi: Vicinity of Namosi, alt. 400–800 m., *Parks 20179* (A, Bish) (low shrub, in wet canyon), *Gillespie 2525* (Bish) (seeds white). OVALAU: Vicinity of Levuka, alt. 350–400 m., *Gillespie 4483* (A, Bish), *4561* (Bish).

TONGA: EUA: *Parks 16044* (GH) (in pockets of limestone rocks on the Liku side of the plateau).

2. **Procris anfracta** (A. C. Sm.) comb. nov.

Elatostema anfractum A. C. Sm. in Bishop Mus. Bull. **141**: 58. *f. 26*. 1936.

TAVEUNI: Western slope, between Somosomo and Wairiki, alt. 700–900 m., *Smith 744* (Bish, TYPE, GH, NY, UC, US) (vine, in forest, the fruiting heads bright red).

This species and the two following differ from *P. Wightiana* Wall. (ampl. Schröter in Rep. Sp. Nov. **45**: 191, 192, 257–259. 1938) in having the pistillate inflorescences with more obvious and more slender peduncles and the leaf-blades usually entire rather than obviously crenate (although in *P. Goepeliana* inconspicuous undulate crenations are present). The differences among our species in leaf-texture and cystolith-marking are very conspicuous and appear to me of a specific nature. The above-cited collection apparently had not come to Schröter's attention at the time of her monograph, although a duplicate is in the Berlin herbarium.

3. **Procris Archboldiana** sp. nov.

Frutex scandens ubique glaber, ramulis subteretibus siccitate striatis brunneis apicem versus ramosis; stipulis oblongo-linearibus acutis 3–6 mm. longis mox caducis; foliis oppositis forsan interdum disparibus, minoribus mox deciduis, alteris petiolatis; petiolis gracilibus 4–8 mm. longis; laminis subcarnosis opacis in sicco fuscis saepe falcatis elliptico-oblongis, 4–8 cm. longis, 1.5–2.5 cm. latis,

basi inaequilateraliter obtusis, apice gradatim acuminatis vel cuspidatis, margine integris vel leviter undulatis, ubique cystolithis conspicuis 0.1–0.25 mm. longis ornatis (eis paginae inferioris densissime confertioribus), pinnatinerviis, costa supra leviter impressa subtus subprominente, nervis lateralibus utrinsecus 5–7 adscendentibus supra interdum prominulis; inflorescentiis ♀ axillaribus solitariis vel binis pedunculatis, pedunculis rectis gracilibus 4–13 mm. longis, capitulis subglobosis carnosis sub fructu 3–6 mm. diametro multifloris; bracteolis numerosis membranaceis lineari-oblongis, circiter 1 mm. longis et 0.2 mm. latis, apice obtusis; perianthii segmentis obovatis succulentis, 1–2 mm. longis et latis, basi angustatis; achenio ovoideo-ellipsoideo complanato, 1–1.3 mm. longo, 0.8–1 mm. lato, basi et apice obtuso.

Viti Levu: Tholo North: Nandarivatu, alt. 900 m., *Gillespie 3396* (A, Bish) (vine; fruiting heads red, gelatinous; native names: *ndraindrai, sundro*); Nauwanga, vicinity of Nandarivatu, alt. 750 m., *Degener 14354* (A, type), Feb. 13, 1941 (liana, appressed to tree-trunks in dark wet forest; peduncle green; fruiting heads dull red and somewhat translucent).

Procris montana (Endl.) Steud. has been mentioned by Gibbs (in Jour. Linn. Soc. Bot. **39**: 172. 1909) and Turrill (in Jour. Linn. Soc. Bot. **43**: 39. 1915) as occurring at Nandarivatu. That species, originally described from Norfolk Island, has been referred to *Elatostema* by Schröter (in Rep. Sp. Nov. **45**: 290. 1938); its occurrence in Fiji is very dubious. It is possible that Gibbs and Turrill had specimens of the present species.

4. **Procris Goepeliana** (A. C. Sm.) comb. nov.

Pellionia Goepeliana A. C. Sm. in Bishop Mus. Bull. **141**: 56. *f. 25.* 1936.

Viti Levu: Naitasiri: Korombamba Mt., alt. about 300 m., *Parks 20144* (A, Bish) (on wet log; fruiting heads red), *Parks 20343* (A, Bish) (vine, on log in forest; fruiting heads red). Koro: Eastern slope of main ridge, alt. 300–500 m., *Smith 979* (Bish, GH, NY, UC, US) (high-climbing liana, in forest; perianth greenish, the anthers white). Vanua Levu: Thakaundrove: Korotini Range, southern slope, alt. 300–650 m., *Smith 519* (Bish, type, GH, NY, UC, US) (subligneous herb 1 m. high, in dense forest; flower-buds pale green); Mt. Mariko, alt. 600–866 m., *Smith 433* (Bish, GH, NY, UC, US) (slender shrub 1–2 m. high, in dense forest; flower-buds green).

The three specimens upon which the species was originally described bear staminate inflorescences, and I erroneously referred the plant to *Pellionia*. The Parks specimens are quite similar, although the leaf-blades are a trifle thicker and more nearly entire, but the cystolith-markings are identical. The pistillate inflorescences of these Viti Levu specimens are nearly identical with those described for *P. Archoldiana*. The two species are readily distinguished by the size of their leaves and the distribution of their cystoliths.

Boehmeria Jacq.

Boehmeria virgata (Forst. f.) Guillem. in Ann. Sci. Nat. II. **7**: 182. 1837.

Urtica virgata Forst. f. Fl. Ins. Austr. Prodr. 66. 1786.

Boehmeria platyphylla var. *virgata* Wedd. in Arch. Mus. Paris **9**: 366. 1856; in DC. Prodr. **16**(1): 210. 1869.

Boehmeria platyphylla sensu Seem. Fl. Vit. 242. 1868; Gibbs in Jour. Linn. Soc. Bot. **39**: 173. 1909; non D. Don.

While there are admittedly difficulties in drawing satisfactory specific lines among *B. platyphylla* D. Don (1825) and its allies, it seems obvious that the Pacific material which has been referred to that species differs specifically from the continental and typical material in details of leaf-margins, texture, pubescence, etc. Among the abundant Fijian material of the genus which I have examined,

two forms are distinguishable, (1) plants with the leaf-blades glabrous above and with the pubescence beneath limited to the nerves and often appressed, and (2) plants with the leaf-blades more or less regularly appressed-strigose above and uniformly soft-pilose beneath. The first form tends to have slightly larger pistillate perianths than the second. Between these extremes are to be found intergrading forms, so that no line for nomenclatural separation seems advisable.

The first of these forms is quite identical with material from the Society Islands which certainly represents *B. virgata*. Even if one prefers to accept Weddell's broad specific concept, Forster's antedates Don's name by many years. However, few modern taxonomists will agree that the Pacific material is conspecific with that from the continent. True *B. virgata*, on the basis of material now available to me, seems to occur from the Marquesas and Societies westward at least to the New Hebrides. Below, in citing the available Fijian specimens, I refer them to forms (1) and (2) as outlined above:

(1). VITI LEVU: Tholo North: Vicinity of Nandarivatu, alt. 800–1300 m., *Gillespie 4036* (A, Bish) (native name: *kau lolo*), *Parks 20587* (A, Bish) (tree 8–10 m. high, in forest), *Degener & Ordonez 13536* (A) (shrub 3 m. high, in forest), *Degener 14327* (A) (shrub to 2 m. high, in secondary forest; native name: *tautau*); Namosi: Near Namosi: alt. 450 m., *Gillespie 2833* (Bish). KANDAVU: *Smith 197, 209, 278, 284* (all Bish, GH, NY, UC, US) (shrubs or trees to 5 m. high, in forest, alt. 200–840 m.). VANUA LEVU: Thakaundrove: Valanga Range, alt. 200–400 m., *Smith 393* (Bish, GH, NY, UC, US) (shrub 3 m. high, in dense forest). WITHOUT DEFINITE LOCALITY: *Seemann 433* (GH), *Gillespie 2753* (A, Bish) (native name: *rambi*), *2916* (Bish), *3945* (A, Bish) (native name: *kau lolo*).

(2). VITI LEVU: Lautoka: North of Natalau, alt. 15 m., *Degener 15008* (A) (tree 3 m. high, in dry rocky forest); Ra: Near Rewasa, alt. 50–200 m., *Degener 15337* (A) (shrub about 1 m. high, in open forest; native name: *ndrendre*); Naitasiri: Tholo-i-suva, alt. 250 m., *Parks 20079* (A, Bish) (shrub 4 m. high). KORO: Eastern slope of main ridge, alt. 200–300 m., *Smith 944* (Bish, GH, NY, UC, US) (shrub 4 m. high, at edge of forest; native name: *ndongosele*). TAVEUNI: Waiyevo, alt. 200 m., *Gillespie 4696* (A, Bish) (shrub with decumbent arched branches, at edge of clearings). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (US), *Seemann 432* (GH), *Horne 303* (GH).

PIPTURUS Wedd.

In examining the Fijian specimens of *Pipturus*, all of which belong in the Section *Eupipturus*, one meets the same problems of specific limitation so ably discussed by Skottsberg (in Acta Hort. Gothoburg. **7**: 43–63. *f. 1–19*. 1932) in connection with *P. argenteus* and its allies. Although Skottsberg does not discuss any Fijian collections in his treatment, some of our plants are obviously similar to the specimens he cites from Samoa and Rotuma. He concludes that these, together with the mass of Pacific and Papuasian material, may be referred to *P. argenteus* (Forst. f.) Wedd. in the broad sense, and more narrowly to the proposed variety *lanosus* Skottsb.

By earlier authors, several other specific names have been used for the Fijian material of this complex, namely *P. incanus* (Bl.) Wedd. (which Skottsberg [l. c. 62] believes may possibly be retained as a species of Java and Malacca), *P. propinquus* (Dec.) Wedd. (which Skottsberg [l. c. 47] proposes to retain as a variety of *P. argenteus* from Timor), and *P. velutinus* (Dec.) Wedd., which is presumably a synonym of *P. incanus*.

It is now apparent, in the light of Skottsberg's treatment, that none of these names is applicable to the Fijian material. Nevertheless I am able to distinguish three well marked forms which seem to me to merit specific status. One of these

is obviously the widespread *P. argenteus* (var. *lanosus*), a second is *P. platyphyllus* Wedd., and a third is apparently a new species, with the manuscript name *P. gracilipes* A. Gray but never described. The following key will serve to distinguish the species of *Pipturus* in Fiji:

Leaf-blades conspicuously discolorous, densely white- or grayish-lanate beneath with a closely appressed layer of weak tangled hairs, papillose above and sparsely hispid-setose with pale hairs 0.4–0.9 mm. long; pistillate perianth minutely sericeous, the hairs 0.05–0.15 mm. long ..... 1. *P. argenteus* var. *lanosus*.

Leaf-blades essentially concolorous, densely pilose beneath (hairs cinereous, subhispid, erect, 0.25–0.8 mm. long, not tangled, not obscuring the leaf-surface), papillose above and subsimilar or strigose-hispid, often glabrescent; pistillate perianth hispid-strigose, the hairs 0.15–0.25 mm. long ..... 2. *P. platyphyllus*.

Leaf-blades concolorous, short-strigillose-puberulent beneath (hairs pale, 0.05–0.15 mm. long, scarcely apparent under a hand-lens), papillose above and glabrous or with a few inconspicuous straight appressed pale hairs 0.25–0.35 mm. long; pistillate perianth inconspicuously puberulent-sericeous, the hairs 0.03–0.1 mm. long ..... 3. *P. vitiensis*.

1. **Pipturus** (§ *Eupipturus*) **argenteus** (Forst. f.) Wedd. var. **lanosus** Skottsb. in Acta Hort. Gothoberg. **7**: 62. 1932.

VITI LEVU: Lautoka: North of Lomolomo, alt. 90 m., *Degener & Ordonez 13654* (A) (spreading tree 2 m. high, on edge of forest); north of Natalau, alt. 60 m., *Degener 15007* (A) (small tree, in dry forest); Tholo North: Korovou, east of Tavua, alt. 60–150 m., *Degener 14947* (A) (tree 3–4 m. high, in isolated dry forested ravine); Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. about 800 m., *Degener 14462* (A) (shrub, in scrubby forest; native name: *feu*); Naitasiri: Waindina River basin, alt. 50 m., *MacDaniels 1048* (Bish) (tree 6 m. high, in forest; native name: *rongga*). OVALAU: *Gillespie 4561.5* (A, Bish). KORO: Coastal thickets along west coast, *Smith 1078* (Bish, GH, NY, UC, US) (shrub 3 m. high; native name: *ronga*). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (GH, US), *Harvey* (GH), *Horne 345* (GH).

The above-cited specimens certainly fall into the concept covered by Skottsberg in his discussion of specimens from Samoa, Tonga, and Rotuma. The differences between this form and the typical material of *P. argenteus* from the Society Islands are found primarily in the indument of the lower surfaces of leaf-blades. I do not believe that Skottsberg's concept of either the variety or the species includes specimens which completely lack the matted lanate indument. Such specimens I refer to the following two species.

2. **Pipturus** (§ *Eupipturus*) **platyphyllus** Wedd. in DC. Prodr. **16**(1): 235[19]. 1869; Seem. Fl. Vit. 433. 1873.

VITI LEVU: Lautoka: North of Lomolomo, alt. 90 m., *Degener & Ordonez 13653* (A) (much-branched shrub 1 m. high, on sunny grassy slope). VANUA LEVU: *U. S. Expl. Exped.* (GH, US); Thakaundrove: Maravu, near Salt Lake, alt. near sea-level, *Degener & Ordonez 14230* (A) (shrub or tree 2–3 m. high, on embankment near ocean); Uluinabathi Mt., Savu Savu Bay region, alt. 60 m., *Degener & Ordonez 13928* (A) (tree 3 m. high, on lower sunny slope). WITHOUT DEFINITE LOCALITY: *Gillespie,* Dec. 29, 1927 (A, Bish) (native name: *ngala*).

The type is said to have been collected on Ovalau by Vieillard. Although I have not seen this, our specimens agree well with the description, which states, ". . . foliis . . . concoloribus supra asperato-hispidis subtus molliter pubescentibus . . ." Such a description could scarcely be applied to the specimens which I have cited as *P. argenteus* var. *lanosus*. Whether or not *P. platyphyllus* merits specific status is a question which should be considered in connection with Pacific material as a whole. It is to be hoped that Dr. Skottsberg will again treat this group, with more ample material than he had in 1932. Christophersen (in Bishop Mus. Bull. **128**: 75. 1935) cites numerous Samoan specimens as *Pipturus* aff. *argenteus,* and among them may be forms referable to *P. platyphyllus*.

3. **Pipturus** (§ *Eupipturus*) **vitiensis** sp. nov.

Pipturus gracilipes A. Gray ex Wedd. in DC. Prodr. **16**(1): 235[20], nomen. 1869; Seem. Fl. Vit. 433, nomen. 1873.

Frutex vel arbor gracilis ad 6 m. alta, ramulis subteretibus saepe flexuosis juventute minutissime cinereo-puberulis demum glabratis; foliis apicem ramulorum versus saepe numerosis, petiolis gracilibus ut ramulis puberulis (2–) 3–8.5 cm. longis, laminis papyraceis concoloribus siccitate fusco-viridibus ovato-ellipticis, (5–) 7–11 cm. longis, (2–) 3–8.5 cm. latis, basi rotundatis vel late obtusis, apice gradatim acuminatis (acumine ad 2 cm. longo mucronulato), margine obtuse crenato-dentatis (dentibus 1–3 per centimetrum), supra minute papillosis et glabris vel pilis paucis inconspicuis pallidis sparse strigosis, subtus pilis pallidis 0.05–0.15 mm. longis inconspicue strigilloso-puberulis, costa saepe pallida supra subplana vel leviter elevata subtus subprominente, nervis secondariis utrinsecus circiter 4 (infimis e basi adscendentibus) supra subplanis subtus leviter elevatis, rete venularum intricato subtus manifesto pilis non obscuro, areolis ultimis minutis; stipulis papyraceis oblongo-deltoideis 2.5–3 mm. longis acutis bicostatis sericeo-puberulis; inflorescentiis masculis non visis; inflorescentiis femineis simpliciter glomerato-spicatis gracilibus 2–6 cm. longis, rhachi gracili minute puberula saepe flexuosa, glomerulis multifloris 3–7 mm. inter se distantibus, receptaculo puberulo, bracteis lineari-oblongis puberulis circiter 0.5 mm. longis; perigonio submembranaceo ovoideo sub anthesi circiter 0.7 mm. sub fructu circiter 1.3 mm. longo, obscure plurinervato, inconspicue puberulo-sericeo, apice minute 4-lobato; nuce ovoidea compressa circiter 1 mm. longa et 0.7 mm. lata, breviter apiculata, stigmate 1–1.7 mm. longo.

FULANGA: Near Monothaki, alt. 0–80 m., *Smith 1108* (Bish, GH, NY, UC, US) (shrub 1–2 m. high, in thickets on limestone formation; native name: *ronga*). KAMBARA: Near Tokalau, alt. 0–100 m., *Smith 1233* (Bish, GH, TYPE, NY, UC, US), Mar. 2, 1934 (slender tree 6 m. high, on edge of forest on limestone formation; native name: *ronga*). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (source of the name *Pipturus gracilipes,* GH, US).

On the basis of the very short and inconspicuous pubescence of its leaf-blades, *P. vitiensis* must be considered specifically distinct from *P. platyphyllus* and *P. argenteus*. The leaves appear to be glabrous until closely examined. It seems advisable to ignore Gray's manuscript name and to designate as the type a more recent collection which is widely distributed in American and European herbaria. The possibility that the Exploring Expedition specimen also came from Fulanga is suggested by the following note of Pickering (Geogr. Distr. of Animals and Plants **2**: 365. 1876): "Boehmeria-like but the leaves alternate (No. 1). Leaves petioled; aments consisting of strings of capit. 'Island of Fulari,' Dr. Holmes." As the specimens of this collection are not numbered, one cannot too surely tie them to Pickering's notes, but the above description fits our plant, and "Fulari" may well refer to Fulanga. Thus the species may prove to be limited to the Lau group.

SANTALACEAE

Exocarpus vitiensis sp. nov.

Frutex vel arbor ad 7 m. alta ubique praeter inflorescentiam glabra, ramulis subteretibus vel juventute leviter angulatis; petiolis gracilibus 2–5 mm. longis supra leviter canaliculatis; laminis viridibus vel siccitate fusco-viridibus chartaceis elliptico-oblongis, 4–9 cm. longis, 2–3.5 cm. latis, basi in petiolum attenuatis, apice obtusis vel inconspicue calloso-cuspidatis, margine integris, nervis primariis 5–9 a basi divergentibus supra leviter impressis vel prominulis subtus paullo elevatis, venulis reticulum inconspicuum immersum vel utrinque leviter prominulum formantibus; inflorescentiis ubique minute cinereo-puberulis, spicis axillaribus solitariis sub anthesi stipite inconspicuo incluso ad 15 mm. sub fructu ad 32 mm. longis, rhachi

1–1.3 mm. diametro; floribus 30–40 per inflorescentiam in foveolis inconspicuis sessilibus, bracteis minutis late deltoideis obtusis; perianthio sub anthesi 1.5–1.7 mm. diametro, tubo hemisphaerico, lobis 5 valvatis rotatis tenuiter carnosis deltoideis subacutis 0.5–0.7 mm. longis et latis intus obscure puberulis; disco carnoso pentagono; staminibus 5, antheris ad marginem disci subsessilibus inflexis transverse ellipsoideis 0.3–0.4 mm. latis, loculis rimis introrso-lateralibus dehiscentibus; ovario in disco semi-immerso, stigmate sessili; fructibus minute cinereo-puberulis glabrescentibus, parte inferiore obconica ad 9 mm. longa et summo ad 8 mm. diametro, fructibus ipsis semi-ovoideis ad 10 mm. longis et basim versus ad 8 mm. diametro, leviter 5-angulatis, apice truncatis et inconspicue emarginatis.

Viti Levu: Tholo North: Nandarivatu, alt. 800–900 m., *Degener & Ordonez 13557* (A, TYPE), Nov. 20, 1940 (shrub or small tree about 2 m. high, in rain-forest). Vanua Mbalavu: Northern limestone section, alt. 150 m., *Smith 1502* (GH, NY) (tree 7 m. high, in forest on exposed cliff).

This is the species which I questionably referred to *E. latifolius* R. Br. (in Bishop Mus. Bull. **141**: 49. 1936). The Viti Levu collection bears good flowers and a single mature fruit, making desirable a separation of the cited material from the well-known Australasian and Malaysian species, which is doubtless its closest ally. *Exocarpus vitiensis* differs from *E. latifolius* in having its spikes apparently always solitary (rather than often several in leaf-axils or branched), its flowers comparatively less crowded and larger (1.5–1.7 mm. rather than 1–1.3 mm. in diameter), and its fruits semi-ovoid, lightly 5-angled, and about equal in length to the swollen stalk (rather than subglobose, smooth, and conspicuously larger than the stalk).

BALANOPHORACEAE

Balanophora fungosa J. R. & G. Forst. Char. Gen. 100. 1776; G. Forst. Fl. Ins. Austr. Prodr. 64. 1786; Seem. Fl. Vit. 99. 1865.

Viti Levu: Ra: Vatundamu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15418* (A) (parasitic on roots of a *Citrus* and other species, on dry forested forehill; entire plant pale yellow except for grayish rootstock, appearing just above surface of ground when flowering; native name: *tumbutumbu*).

The only previously cited collection of this family from Fiji was a specimen collected by Milne on Moala, which Seemann did not see but which he cites on the authority of Milne (in Hook. Jour. Bot. & Kew Misc. **7**: 152. 1855). Seemann gives no reason for referring Milne's collection to *B. fungosa,* but he implies this to be the common Pacific species, extending from the Society Islands to the New Hebrides and Australia. The species of the Society Islands has since been referred to *B. pallens* (Sol.) Setchell (in Univ. Cal. Publ. Bot. **12**: 173. *pl. 29, 30.* 1926). Setchell (l. c.) implies that the Australian plant which J. D. Hooker (in Trans. Linn. Soc. 22: 46. *pl. 8.* 1856) refers to *B. fungosa* may actually differ from that species. As to the Degener collection, however, there seems little doubt that it is conspecific with the New Hebrides plant which is the type of the species, as this is described and figured by J. R. and G. Forster (Char. Gen. 99, 100. *pl. 50.* 1776). Although *B. fungosa* may be locally common at certain seasons, it is definitely rare in herbarium collections. Its rediscovery in Fiji and the collection of fine herbarium material are of great interest.

AMARANTHACEAE

Deeringia amaranthoides (Lam.) Merr. Interpret. Herb. Amb. 211. 1917.

Viti Levu: Ra: Vatundamusewa, vicinity of Rewasa, near Vaileka, alt. about 200 m., *Degener 15463* (A) (liana, in open forest; leaves edible when cooked; native name: *tokoi*).

Koro: East coast, near sea-level, *Smith 1032* (GH, NY) (vine, in thickets). Without locality: *U. S. Expl. Exped.* (GH).

This common continental and Malaysian plant has not been reported in the Pacific east of Papuasia, as far as I can discover, except from Micronesia. The genus is new to the Fijian flora.

Alternanthera sessilis (L.) R. Br. ex R. & S. Syst. **5:** 554. 1819; Christoph. in Bishop Mus. Bull. **128:** 83. 1935.

Viti Levu: Tholo West: Mbelo, near Vatukarasa, alt. 120 m., *Degener 15216* (GH) (in shallow water of marsh).

Although said to be common in Samoa, this weed has apparently not previously been reported from Fiji.

ANNONACEAE

Desmos insularis sp. nov.

Arbor compacta circiter 5 m. alta, ramulis gracilibus teretibus fusco-cinereis copiose lenticellatis, juventute pilis brunneo-cinereis ad 1 mm. longis simplicibus strigosis mox glabratis; petiolis inconspicuis subteretibus 1–2 mm. longis ut ramulis strigosis; laminis chartaceis vel papyraceis anguste elliptico-oblongis, 4–10 cm. longis, 1.5–4 cm. latis, basi cordatis vel truncato-subcordatis, apice obtusis, margine integris et planis, supra glabris vel juventute et interdum nervis parce hispidis, subtus pilis simplicibus circiter 0.5 mm. longis albo-cinereo-hispidulis, costa supra subplana vel leviter elevata subtus valde elevata, nervis secundariis utrinsecus 7–12 subpatentibus marginem versus adscendentibus et irregulariter conjunctis supra leviter subtus conspicue prominulis, rete venularum intricato utrinque paullo prominulo; inflorescentiis axillaribus breviter paniculatis 1–1.5 (–3.5) cm. longis, rhachi ramulisque rugulosis parce cinereo-pilosis, bracteis lanceolato-deltoideis 1.5–2 mm. longis acutis adpresso-strigulosis; floribus pluribus sed sub anthesi plerumque solitariis, pedicellis crassis strigulosis circiter 2 mm. longis bractea orbiculari circiter 0.5 mm. diametro caduca subtentis; calyce sub anthesi 3–4 mm. diametro extus brunneo-striguloso intus glabro fere ad basim 3(vel 4-)-lobato, lobis deltoideis valvatis acutis circiter 1.5 mm. longis et latis; petalis 6 (raro 8) biseriatis ut videtur valvatis subcarnosis subaequalibus ovatis, circiter 3.5 mm. longis, 1.3–2 mm. latis, apice breviter acuminatis, extus dense brunneo-tomentellis, intus glabris apicem versus tomentellis; toro leviter concavo pilis circiter 0.3 mm. longis brunneo-crisposo-strigoso; staminibus numerosis (70–80) congestis 0.8–1.2 mm. longis, filamentis minutis, connectivo apicem versus incrassato et truncato, loculis lineari-ellipsoideis; pistillis paucis (ut videtur 4 vel 5) sub anthesi circiter 1.5 mm. longis, ovario pallide brunneo-setoso oblongo-ellipsoideo obscure pellucido-punctato, ovulis circiter 6–8 ut videtur biseriatis, stigmate subsessili subgloboso circiter 0.3 mm. diametro; pedicellis sub fructu incrassatis glabratis a rhachi haud distinctis, calyce subpersistente, receptaculo parvo dense strigoso; carpellis plerumque 2–4 ellipsoideo-oblongis plerumque 2.5–4 cm. longis et 7–10 mm. diametro subtorulosis, basi in stipitem 2–4 mm. longum abrupte contractis, apice conspicue cuspidatis (apice circiter 2 mm. longo obtuso), pericarpio tenui duro pilis minutis densissime brunneo-tomentello plerumque conspicue tuberculato, seminibus 6–8 (vel ut videtur raro ad 1 reductis) oblique superpositis subglobosis vel complanatis.

Viti Levu: Tholo North: Korovou, east of Tavua, alt. 60–120 m., *Degener 14968* (A, type), Apr. 1, 1941 (compact tree 5 m. high, in isolated dry forested ravine; fruit brownish gray).

The generic disposition of this plant, which is one of Mr. Degener's most interesting discoveries, is questionable. The essential characters, however, seem to point to the genus *Desmos* Lour., which has not previously been reported east of

the Philippines. Our plant is almost certainly a member of the tribe Unoneae, in which its free petals and numerous ovules indicate such genera as *Canangium* Baill. and *Desmos* Lour. (the correct genus for the Old World species once referred to *Unona* L.). The new species is characterized by its comparatively small and thin leaf-blades, which are persistently pilose beneath and with inconspicuous veinlets. Only a single mature flower and one bud were found, and so the above dimensions are not reliable, although they indicate unusually small flowers for the genus. Additional flowering material may well indicate the desirability of erecting a new genus for this plant. The fact that the ovules are biseriate and the seeds obliquely rather than strictly superposed would seem to differentiate it from the species of *Desmos*. In the absence of ample flowering material, however, it seems unwise to propose a new genus for the Fijian plant at present. The fruits of our species are conspicuous for their close persistent pubescence, cuspidate apices, and tuberculate surfaces.

Were the petals of our plant imbricate, the genus *Uvaria* L. might be considered, but *Uvaria* is excluded by its perianth characters, scandent habit, and the presence of stellate hairs. The New Caledonian representative of *Uvaria, U. Baillonii* Guillaumin, seems very dubiously placed in that genus.

Polyalthia pedicellata A. C. Sm. in Bishop Mus. Bull. **141**: 61. *fig. 29.* 1936.

Viti Levu: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. about 750 m., *Degener 14719* (A), *14737* (A) (trees, in forest; bark used for rope; native name: *makosoi*).

The two cited collections, both in fruit, agree excellently with the type and only previously known collection, obtained at high elevation on Vanua Levu.

Xylopia vitiensis nom. nov.

Fissistigma sericeum A. C. Sm. in Bishop Mus. Bull. **141**: 62. *fig. 30.* 1936; not *Xylopia sericea* St. Hil. (1825).

Viti Levu: Rewa: Vicinity of Suva, *Tothill F516* (A).

I erroneously referred this species to *Fissistigma* in 1936. A re-examination and due consideration of such characters as the arboreal habit, the narrow petals, and the flattened or slightly concave receptacle indicate the place of the species in *Xylopia* L. The genus *Fissistigma,* therefore, is still unknown from Fiji. *Xylopia* has not previously been reported east of Papuasia and New Caledonia. The alliance of our species with those of the nearest areas is remote.

The Tothill specimen agrees perfectly with the type, collected on the lower slopes of Mt. Mbatini on Vanua Levu, in vegetative characters. It is accompanied by a single detached carpel which is apparently not quite mature. This carpel, identical with those of the type in shape and proportions, lacks the lining of air-cavities previously described and figured by me. It may be assumed that these develop only with age or that they do not provide a constant character.

Xylopia Degeneri sp. nov.

Arbor circiter 4 m. alta ubique praeter inflorescentiam et ramulos juveniles puberulos glabra, ramulis purpurascentibus conspicue flexuosis rugosis copiose et pallide lenticellatis; petiolis gracilibus (circiter 1.5 mm. diametro) canaliculatis rugulosis 15–20 mm. longis; laminis subcoriaceis siccitate viridi-olivaceis oblongo-ellipticis, 7–10 cm. longis, 3–4.5 cm. latis, basi late obtusis et in petiolum decurrentibus, apice rotundatis et interdum inconspicue callosis, margine integris et paullo incrassatis, subtus inconspicue sed dense pallido-glandulosis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 9–12 patentibus marginem versus anastomosantibus cum rete venularum intricato utrinque valde prominulis; inflorescentiis apicem ramulorum versus axillaribus brevibus pauci-

floris (sub anthesi floribus plerumque solitariis), rhachi pedicellisque parce pallido-aureo-sericeis, pedicellis crassis sub anthesi 2–3 mm. longis bractea suborbiculari sericea 1–1.5 mm. longa subtentis; calyce subrotato sub anthesi 8–9 mm. diametro ut pedicellis pilis 0.2–0.3 mm. longis extus sericeo intus glabro, sepalis 3 ovato-deltoideis circiter 5 mm. longis et latis apice acutis vel cuspidatis; corolla cylindrico-urceolata inconspicue hexagona 28–30 mm. longa, basi conspicue dilatata, petalis 6 crasse carnosis valvatis biseriatis, exterioribus 3 lanceolatis circiter 3 mm. latis, basim versus ad 5–6 mm. dilatatis, extus dense aureo-sericeis, intus minute et pallide puberulis, interioribus 3 subulatis minute puberulis trigonis 1–1.2 mm. latis, basim versus ad 4 mm. subito incrassatis; toro leviter convexo vel complanato; staminibus numerosis congestis 2–2.2 mm. longis, filamentis ligulatis brevissimis, connectivo in appendiculam subglobosam minute papillosam circiter 0.25 mm. diametro producto, loculis linearibus septatis; pistillis paucis ut videtur stamina longitudine subaequantibus, ovario ellipsoideo pallide sericeo, ovulis circiter 8 superpositis; pedicellis sub fructu incrassatis ad 8 mm. longis, receptaculo subgloboso, carpellis maturis ut videtur 5–8 coriaceis anguste ellipsoideo-oblongis plerumque inconspicue torulosis, stipite incluso 2.5–4.5 cm. longis, 6–8 mm. latis, inconspicue circumcarinatis, basi in stipitem crassum ad 1 cm. longum contractis, apice inaequilateraliter obtuse cuspidatis, pericarpio tenui (circiter 0.5 mm. crasso), seminibus circiter 6 (vel abortu paucioribus) superpositis obliquis brunneis nitidis ovoideis, 8–9 mm. longis, 3–5 mm. latis.

Viti Levu: Serua: Vatutavathe, vicinity of Ngaloa, alt. 150 m., *Degener 15204* (A, type), May 5, 1941 (tree 4 m. high, in forest; flowers yellowish).

In vegetative characters, *X. Degeneri* is scarcely distinguishable from *X. vitiensis* A. C. Sm., having essentially similar leaves; the branchlets of the new species are more conspicuously and regularly flexuose. The flowers of *X. Degeneri* resemble those of its relative in such characters as pubescence and general appearance, differing in their much longer petals and stamens, the latter being 3–4 times the length of those of *X. vitiensis* and having conspicuously septate locules. The fruits of the new species differ in shape from those of *X. vitiensis,* being longer and much narrower, with a more conspicuous stipe and with slight dorsal and ventral keels. The pericarp is thinner and lacks air-cavities, while the seeds are somewhat smaller. That the described fruits are quite mature is shown by the fully developed endosperm.

Cyathocalyx vitiensis A. C. Sm. in Bishop Mus. Bull. **141**: 64. *fig. 31.* 1936.

Viti Levu: Tholo North: Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. 750 m., *Degener 14638* (A) (tree, in forest; flowers green; bark used for rope; native name: *makosoi*); Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13744* (A) (few-branched tree 5 m. high, in open forest; flowers greenish).

The species has previously been known only from the type collection, obtained in the Wainunu River valley on Vanua Levu. The cited specimens agree excellently with the type.

Oxymitra monosperma (A. Gray) A. C. Sm. in Bishop Mus. Bull. **141**: 62. 1936.

Richella monosperma A. Gray, Bot. U. S. Expl. Exped. **1**: 28. *pl. 2.* 1854; Seem. Fl. Vit. 5. 1865.

Viti Levu: Tholo North: Nandala, vicinity of Nandarivatu, alt. 750 m., *Degener 14385a* (A) (slender few-branched cauliflorous tree 6 m. high, in dense forest); Mt. Matomba, Nandala, alt. 750 m., *Degener 14639* (A) (tree, in forest; bark used for rope; native name: *makosoi*); Naitasiri: Vicinity of Nasinu, near Suva, alt. 150 m., *Gillespie 3652* (GH, NY). Ovalau: Near summit of main range west of Levuka, alt. 500 m., *Gillespie 4440* (GH, NY).

At the time I proposed the above combination I had seen only the type collection, from Ovalau. The cited specimens agree very well with this and serve to give a better picture of the distribution of the species.

Annona glabra L. Sp. Pl. 537. 1753.

VITI LEVU: Serua: Ngaloa, near sea-level, *Degener 15069* (A) (tree 2–3 m. high, in wet coastal meadow; petals yellow, reddish within toward base; fruit red, edible when ripe; native name: *kaitambu*).

This species has not previously been reported from Fiji and apparently has not been commonly introduced into the Asiatic tropics.

Annona squamosa L. Sp. Pl. 537. 1753.

FULANGA: On limestone formation, alt. near sea-level, *Smith 1193* (NY) (tree 10 m. high, in clearing; fruit edible; native name: *apeli*).

This introduced species has not previously been mentioned from Fiji, although it has been reported from several of the neighboring groups.

LAURACEAE

By C. K. ALLEN

Cinnamomum Degeneri Allen, sp. nov.

Arbor, ramulis dense fulvo-tomentosis, mox glabrescentibus teretibus striatis atro-rubescentibus sat robustis. Folia opposita vel alternata, ovata, 6.5–8 cm. longa, 3.5–4.5 cm. lata, subcoriacea, leviter acuminata vel attenuato-acuminata, basi rotundata, supra nitida, glabra, subtus dense et pallide ferrugineo-lanuginosa, mox glabrescentia, triplinervia, nervis supra leviter subtus conspicue elevatis, petiolis gracilibus 1.5 cm. longis glabris atratis. Inflorescentia subterminalis, laxe cymosa, ad 6 cm. longa, dense fulvo-lanuginosa, pauciflora, pedunculis ad 3 cm. longis. Flores 4–5 mm. longi, dense fulvo-lanuginosi, perianthii lobis ovatis, intus pubescentibus ad 2 mm. longis, tubo circiter 2 mm. longo, pedicellis gracilibus lanuginosis ad 1 cm. longis, summis leviter crassis. Fructus ignotus.

VITI LEVU: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. 750 m., *Degener 14531* (A, TYPE), Feb. 24, 1941 (tree, in dense forest; native name: *mathou*).

The leaf outline of this species is not particularly outstanding, being ovate with a more or less attenuately acuminate tip, but the ferrugineous-lanuginose indument covering the young leaves and branchlets is distinctive. Unusual also is the densely fulvous or greyish woolly inflorescence, with large flowers. This heavy indument is reminiscent of that found on *C. sulphuratum* Nees of India, in which, however, it is not as pronounced and is a yellowish brown in color. A few of the flowers are in the post anthesis stage, showing where the line of abscission occurs, leaving the rounded lobes that will eventually enlarge to form the cupule subtending the expanded fruit. The bark of the dried specimen, when scraped, yields a pleasant aromatic fragrance.

Cryptocarya Degeneri Allen, sp. nov.

Arbor ad 6 m. alta, ramulis minute pallide brunneo-pubescentibus mox atro-pubescentibus demum glabrescentibus atro-rubescentibus griseis teretibus striatis. Folia alternata, ovata vel elliptica, (9–) 10–14.5 cm. longa, 4.5–6 cm. lata, pergamentacea, obtuse acuminata, basi rotundata saepe subcordata vel raro abrupte acuminata, utrinque glabra, novella subtus argenteo-sericea, minute et dense glanduloso-punctata, subtriplinervia, nervis brunnescentibus supra leviter et conspicue subtus conspicue elevatis, nervis lateralibus 1 vel 2 sat inconspicuis, venis transversis subparallelibus, utrinque reticulata, petiolis 1–2 cm. longis atratis minute tuberculatis pubescentibus mox glabris. Inflorescentia immatura, axil-

laris, ad 1 cm. longa, fulvo-pubescens mox glabra, pedunculis gracilibus brevibus. Flores ignoti. Fructus in sicco nigrescens, glaber, tuberculatus, leviter costatus, subglobosus, apice perianthii tubi reliquiis coronatus, 10 × 9 mm., pedicellis leviter incrassatis 2 mm. longis 1 mm. crassis pubescentibus.

VITI LEVU: Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15412* (A, TYPE), June 3, 1941 (tree 5 m. high, in forest; bark added to coconut oil for fragrance; native name: *motho*); Tholo North: Vicinity of Nandarivatu, alt. 750 m., *Degener 14311* (A) (tree 3–5 m. high, in dark dense forest along stream); Tholo West: Lumuka, vicinity of Mbelo, near Vatukarasa, alt. 250 m., *Degener 15228* (A) (tree 6 m. high, in forest).

There is no known species from Fiji with which the above may claim relationship. It is similar in many respects to *C. trinervia* Elmer from the Philippines, but the leaves of the latter are elliptic. The fruit and habit resemble those of *C. exfoliata* Allen from New Guinea, but the leaves of the latter are less prominently three-nerved, of thicker texture, and smaller.

Cryptocarya constricta Allen, sp. nov.

Arbor, ramulis novellis breviter ferrugineo-tomentosis mox glabrescentibus teretibus plus minusve striatis griseis. Folia alternata, oblonga, 13–20 cm. longa, 3.7–7 cm. lata, coriacea, caudata vel acuminata, raro obtusa, basi cuneata, supra venis exceptis glabra vel minute pubescentia, subtus glauca, venis utrinque dense ferrugineo-tomentosis, penninervia, nervis 6 vel 7 supra inconspicuis brunnescenti-pubescentibus subtus conspicue elevatis dense ferrugineo-tomentosis, venis transversis subparallelibus, subtus laxe reticulata, petiolis ad 2 cm. longis robustis dense ferrugineo-tomentosis mox glabrescentibus demum glabris striatis. Inflorescentia ignota, probabiliter dense ferrugineo-tomentosa. Fructus in sicco nigrescens, glaber, leviter et obscure costatus, ellipsoideus, utrinque attenuatus, apice perianthii tubi reliquiis coronatus, basi constrictus, 2 × 1.5 cm., pedicellis sat incrassatis brevibus pubescentibus.

VITI LEVU: Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13761* (A, TYPE), Dec. 15, 1940 (tree, in forest).

This species is striking because of the densely ferrugineous-tomentose venation standing out in relief against the pale glaucous grey lower leaf-surface. The fruit constricted at the base, simulating a stipe about twice as wide as the pedicel and only about 2 mm. in length, presents a unique character. There is no known species with which the above has a close affinity, although it bears a superficial resemblance in fruit and leaf characters to several recently described species from New Guinea.

Endiandra monticola A. C. Sm. in Bishop Mus. Bull. **141**: 71. *fig. 36.* 1936.

VITI LEVU: Naitasiri: Suva Pumping Station, in forest, alt. 30 m., *Degener & Ordonez 13775* (A).

The type, *Smith 563* from Vanua Levu, is in flower. Degener's number is apparently the only fruiting specimen that has been collected. Unfortunately it is a poor specimen and a unicate, and hence description of the fruit must be postponed until better material is available. There can be no doubt, however, that the two numbers are conspecific.

CRASSULACEAE

Bryophyllum pinnatum (Lam.) Kurz in Jour. As. Soc. Beng. **40**(2): 52. 1871.

VITI LEVU: Tholo West: Near Saru, *Tabualewa 15618* (GH) (native name: *thakomana*).

This widespread weed has apparently not otherwise been reported from the group; the family also is new to Fiji.

ROSACEAE

Chrysobalanus Icaco L. Sp. Pl. 513. 1753.

VITI LEVU: Rewa: Near Suva, *Parham 20* (A) (shrub, near a creek; fruit yellow).

This widespread American plant is apparently here first recorded for the Pacific region. According to Mrs. Parham's notes, it is probably becoming naturalized in Fiji.

LEGUMINOSAE

Schrankia distachya DC. Prodr. **2**: 443. 1825, vel aff.

VITI LEVU: Nandronga: Government Farm, Singatoka, *Greenwood 838* (A) (low shrub, up to 1.5 m. high, sending out long shoots near ground level).

Since the specimen bears neither flowers nor fruits, the identification is tentative; our plant agrees with Mexican material of *S. distachya* in its pilose stem and pubescent leaflets, but has the leaflets smaller on the average. The collector notes that the species is evidently a recent arrival in Fiji. The genus has apparently not been recorded from the Pacific area.

Maniltoa grandiflora (A. Gray) Scheff. in Ann. Jard. Bot. Buitenz. **1**: 20. 1876.

Cynometra grandiflora A. Gray, Bot. U. S. Expl. Exped. **1**: 470. *pl. 52.* 1854; Seem. Fl. Vit. 71. 1865.

It seems that the correct authority for the accepted binomial for this Fijian species is Scheffer, even though his description (l. c.) applies exclusively to a New Guinea species which was later named *M. Schefferi* K. Schum. (in K. Schum. & Hollr. Fl. Kais. Wilh. 101. 1889). Because of Scheffer's misidentification of the New Guinea plant, Harms apparently thought it desirable to propose a new combination for Gray's species, *Maniltoa grandiflora* (A. Gray) Harms (in Engl. & Prantl, Nat. Pfl. Nachtr. III. **3**: 194. 1897; in Notizbl. Bot. Gart. Berlin **3**: 191. 1902; in Bot. Jahrb. **55**: 48. 1917). This was not necessary, for the fact that Scheffer misidentified his New Guinea species does not affect the status of his new combination.

Since the genus *Maniltoa* received its first description in connection with *M. grandiflora*, the only binomial proposed by Scheffer, the question of the typification of the genus arises. In this case it is probably advisable to take Scheffer's actual description (later referred to *M. Schefferi*) as the basis of the genus and to designate *M. Schefferi* as the type-species. Nevertheless, the validity of Scheffer's combination based on *Cynometra grandiflora* A. Gray seems unquestionable. Since the two species appear to be congeneric, the selection of the genotype is not likely to cause confusion.

In his original description, Gray indicates that there are two or three forms of this species, and his plate illustrates specimens which have obviously come from three plants. Four sheets are available to me, deposited in the Gray Herbarium and the U. S. National Herbarium. The floral details of the plate are from the specimen illustrated in *fig. B*, and this specimen (US), which has the best inflorescences, is doubtless to be taken as the actual type. The specimen upon which *fig. A* is based is to be found in the Gray Herbarium. Both herbaria have specimens from the plant which served as the basis for *fig. C*. Although slight foliage differences exist among these various specimens, the collections now available do not indicate differences of nomenclatural value. As I interpret the species, it is represented by the following specimens:

VITI LEVU: Nandronga: Singatoka River, *Greenwood 423B* (A) (tree to 23 m. high, in forest along creek; bark gray); Tholo West: Naruku, vicinity of Mbelo, near

Vatukarasa, alt. 250 m., *Degener 15317* (A) (tree 8 m. high, in forest; native name: *yamo;* timbers used for house-posts). VANUA LEVU: *U. S. Expl. Exped.* (illustr. as *fig. B*) (US, TYPE); *U. S. Expl. Exped.* (illustr. as *fig. A*) (GH); Thakaundrove: Uluinabathi Mt., Savu Savu Bay region, *Degener & Ordonez 13949* (A) (tree 3 m. high, in forest). OVALAU: *U. S. Expl. Exped.* (illustr. as *fig. C*) (GH, US). KORO: Eastern slope of main ridge, alt. 300–500 m., *Smith 1022* (GH, NY, US) (tree 20 m. high, in dense forest; leaf-buds brown-pilose). WITHOUT DEFINITE LOCALITY: *Seemann 138,* in part (GH); *Horne 519* (GH).

Maniltoa minor sp. nov.

Arbor ad 13 m. alta sub anthesi ubique glabra, ramulis subteretibus cinereis rugulosis inconspicue lenticellatis; foliis 2-jugis vel interdum apicem ramulorum versus unijugis, petiolis subteretibus rugulosis 3–6 mm. longis, petiolulis inconspicuis circiter 1 mm. longis; laminis foliolorum subcoriaceis in sicco viridi-olivaceis inaequilateraliter ellipticis, 2.5–4 cm. longis, 1.7–2.5 cm. latis, basi latere inferiore rotundatis vel late obtusis superiore gradatim angustatis, apice late obtusis et emarginatis, margine integris et paullo incrassatis, utrinque in sicco rugulosis, costa recta vel leviter curvata utrinque elevata, nervis lateralibus utrinsecus 5–8 cum aliis debilioribus interspersis marginem versus anastomosantibus utrinque paullo prominulis vel supra subplanis, rete venularum intricato subimmerso vel subtus prominulo; inflorescentiis axillaribus racemosis basi multibracteatis, bracteis imbricatis papyraceis concavis, exterioribus late ovatis 1–2 mm. longis, interioribus caducis non visis sed forsan majoribus, rhachi crassa demum 1.5–2 cm. longa basibus florum conspicue incrassata; pedicellis gracilibus teretibus 14–18 mm. longis, basi bractea decidua et bracteolis 2 oblongis circiter 1.5 mm. longis dorsaliter costa sparse hispidis subtentis, apice in receptaculum circiter 1.5 mm. diametro incrassatis; floribus numerosis circiter 15–20 per inflorescentiam; sepalis, petalis staminibusque e margine tubi brevis cylindrici orientibus, tubo 0.5–1 mm. longo basi cicatricoso demum e receptaculo circumciso; sepalis 5 sub anthesi reflexis submembranaceis oblongis, 6.5–7 mm. longis, 2–4 mm. latis, apice obtusis, sparse nervatis; petalis 5 submembranaceis anguste obovato-ellipticis, 7–8 mm. longis, circiter 1.5 mm. latis, apice subacutis, basim versus angustatis; staminibus 25–30, 1- vel 2-seriatis, filamentis filiformibus 10–12 mm. longis, antheris oblongis circiter 1 mm. longis medio dorsifixis, apice mucronulatis; ovario pallido interdum minute puberulo mox glabro breviter stipitato, ovulo unico, stylo filiformi circiter 7 mm. longo, stigmate minute capitato.

MOALA: Near Maloku, alt. 200 m., *Smith 1333* (GH, TYPE, NY, US), Mar. 22, 1934 (tree 13 m. high; petals and filaments white; native name: *thimbithimbi;* wood considered good for houses). WITHOUT DEFINITE LOCALITY: *Seemann 138,* in part (GH).

Maniltoa minor is related to *M. grandiflora* (A. Gray) Scheff., but the two species differ in many obvious floral characters. The sepals, petals, and stamens of *M. grandiflora* are borne separately on the margin of the receptacle, while in *M. minor* these organs arise from a short cylindric tube. At the base of this tube, a ring of scars indicates that bracts were probably present in bud. This character may prove to be of generic significance, but until young inflorescences of *M. minor* are available I prefer to place the species in *Maniltoa.* The ovules of the new species are solitary rather than two per ovary, as in *M. grandiflora.* In addition, the flowers of *M. minor* are smaller in all details, as indicated by the following dimensions for *M. grandiflora:* sepals 10–15 mm. long and 4–7 mm. broad; petals 12–19 mm. long and 3–4 mm. broad; filaments 15–25 mm. long; style 9–10 mm. long. The leaflet-blades of *M. grandiflora* are 4.5–10 cm. long and 2–5.5 cm. broad, being thus substantially larger than those of the new species.

Seemann 138 (GH) consists of collections which appear to have come from three plants. Two of them are referable to *M. grandiflora,* but the third, which

is sterile, has leaves essentially identical with those of *Smith 1333,* and I refer it to the new species with confidence.

Cynometra falcata A. Gray, Bot. U. S. Expl. Exped. 1: 472. 1854; Seem. Fl. Vit. 71. 1865.

Viti Levu: Mba: *U. S. Expl. Exped.* (US, type).

This species has been confused with *Maniltoa grandiflora* in herbaria, but it is easily distinguished from that species by its fewer stamens, small flowers and bracts, and its single pair of leaflets (rather than 2 or 3 pairs as in *Maniltoa grandiflora,* where the leaflets are only rarely reduced to a single pair). I have seen no material referable to *C. falcata* except the type.

Cynometra insularis sp. nov.

Arbor ad 15 m. alta inflorescentiis exceptis glabra, ramulis crassis subteretibus rugulosis cinereis lenticellatis; foliis unijugis petiolatis, petiolis rectis supra interdum leviter canaliculatis 12–25 mm. longis, petiolulis inconspicuis 1–3 mm. longis; laminis foliolorum coriaceis siccitate viridibus vel olivaceis inaequilateraliter oblongis, 6–8 cm. longis, 2.5–4.5 cm. latis, basi latere inferiore rotundatis superiore gradatim angustatis, apice obtuse cuspidatis vel inconspicue emarginatis, margine integris et paullo recurvatis, utrinque in sicco rugulosis, costa recta supra leviter elevata subtus prominente, nervis lateralibus utrinsecus circiter 10 cum aliis debilioribus interspersis supra paullo impressis subtus prominulis vel planis, rete venularum intricato immerso supra inconspicue impresso subtus obscuro; inflorescentiis axillaribus racemosis basi multibracteatis, bracteis imbricatis concavis papyraceis vel subcoriaceis leviter striatis demum caducis, exterioribus subglabris late ovatis circiter 2 mm. longis, interioribus oblongo-ellipticis ad 10 mm. longis et 7 mm. latis, extus dense puberulis vel sericeis, apice obtusis vel rotundatis, rhachi crassa demum 1.5–2.5 cm. longa pilis pallidis circiter 0.5 mm. longis dense patente-pilosa basibus florum conspicue incrassata; pedicellis gracilibus sub anthesi 8–14 mm. longis ut rhachi pilosis, basi bractea decidua ut bracteis basalibus interioribus atque bracteolis 2 anguste oblongis circiter 4 mm. longis puberulis subtentis, apice in receptaculum parvum conspicue incrassatis; floribus numerosis circiter 25–30 per inflorescentiam; sepalis 5 membranaceis sub anthesi reflexis oblongis, 5–6 mm. longis, 2–3 mm. latis, sparse reticulato-nervatis, apice rotundatis, extus puberulis; petalis 5 membranaceis erectis glabris anguste oblongo-ellipticis, 7–8 mm. longis, 2–3 mm. latis, apice subacutis, basim versus angustatis, inconspicue nervatis; staminibus 10 glabris, filamentis filiformibus 10–15 mm. longis, apicem versus gradatim attenuatis, antheris late oblongis medio dorsifixis circiter 1.5 mm. longis, apice mucronulatis, loculis basi divaricatis; ovario breviter stipitato late ellipsoideo complanato ut pedicellis piloso, stylo crasso tereti sub anthesi 4–7 mm. longo, stigmate minuto capitato, ovulo unico; fructibus oblongo-ellipsoideis, circiter 4.5 cm. longis et 3.5 cm. latis et 3 mm. crassis, pericarpio rugoso, suturis leviter impressis.

Viti Levu: Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15433* (A) (tree 6 m. high, in open forest; flowers whitish; native name: *movi;* timbers used for house-posts); Vatundamusewa, near Rewasa, *Degener 15491* (A, type), June 6, 1941 (tree, in open forest); Waindawa, near Rewasa, *Degener 15494* (A) (tree, in open forest; native name: *movi*). Taveuni: Western slope, between Somosomo and Wairiki, alt. 500 m., *Smith 843* (GH, NY, US) (tree 15 m. high, in woods).

Cynometra insularis is a relative of *C. falcata* A. Gray, from which it differs in having its leaves with petioles 12–25 mm. long, those of *C. falcata* being subsessile, on petioles scarcely 3 mm. long. The leaflets of the new species are slightly thicker in texture and have the secondaries lightly impressed rather than prominulous on the upper surface, while in general the venation is less obvious;

the costa is essentially straight rather than falcate, and the leaflets average broader. The inflorescence of *C. insularis* is coarser, longer, and with more numerous flowers than that of *C. falcata,* with more obvious pubescence throughout (the rachis in *C. falcata* being only faintly puberulent). The fully developed inflorescence-scales of *C. falcata* are only about 3 mm. long, and in other respects the inflorescence and floral parts seem to be much smaller than those of the new species, but the type of Gray's species is not sufficiently ample to permit detailed comparison.

The fruits are described from *Smith 843,* the other cited specimens being in flower.

Cassia Tora L. Sp. Pl. 376. 1753; Christoph. in Bishop Mus. Bull. **128**: 99. 1935.

VITI LEVU: Tholo North: Fatia, west of Tavua, alt. 60 m., *Degener 14981* (A) (low shrub to 1 m. high, in dry forested ravine). WITHOUT DEFINITE LOCALITY: *Seemann 135* (GH); *Harvey* (GH).

This widely distributed weed has apparently not previously been listed under the above name in literature pertaining to Fiji. The two early collections cited above were mentioned by Seemann (Fl. Vit. 67. 1865; 427. 1873) as *C. obtusifolia* L., generally considered synonymous with *C. Tora.*

Crotalaria mucronata Desv. in Jour. Bot. Desv. **3**: 76. 1814.

Crotalaria striata DC. Prodr. **2**: 131. 1825.

Crotalaria Saltiana sensu Prain ex King in Jour. As. Soc. Bengal **66**(2): 41 (Mater. Fl. Malay. Penin. **3**: 41). 1897; non Andr. (1811).

VITI LEVU: Lautoka: Mbekana Island, near sea-level, *Degener & Ordonez 15543* (A) (naturalized low shrub). KANDAVU: Namalata Isthmus region, near sea-level, *Smith 12* (NY) (subligneous herb to 2 m. high; petals yellow, purple-striped; weed in clearings; native name: *nggiringgiri*).

Although said to occur commonly enough in various other South Pacific groups, this weed has not previously been mentioned from Fiji. It has usually been listed in Pacific records as *C. Saltiana* Andr., which, as pointed out by Senn (in Rhodora **41**: 356. 1939), belongs to a different section of the genus and is apparently limited to Africa.

Indigofera tinctoria L. Sp. Pl. 751. 1753.

VITI LEVU: Lautoka: Lautoka, *Degener & Ordonez 13626* (A) (shrub to 1 m. high; roadside weed).

This species has not previously been reported from Fiji, although it is found in some other Pacific groups. A discussion of *I. tinctoria,* as compared with *I. suffruticosa* Mill. (*I. Anil* L.), is found in Merrill, Interpret. Herb. Amb. 264. 1917. Possibly some of the references in Pacific literature to *I. Anil* actually refer to *I. tinctoria.*

Erythrina variegata L. var. **orientalis** (L.) Merr. Interpret. Herb. Amb. 276. 1917; Christoph. in Bishop Mus. Bull. **128**: 103. 1935; Krukoff in Jour. Arnold Arb. **20**: 228. 1939.

MAKONDRONGA: *Degener & Ordonez 13803* (A) (tree about 8 m. high, with roots reaching into salt water along coast; seeds dark red).

The correct name for this plant has not previously been recorded in the special literature pertaining to Fiji, it having been mentioned by Seemann (Fl. Vit. 60. 1865) and others as *E. indica* Lam.

Pueraria Thunbergiana (Sieb. & Zucc.) Benth. in Jour. Linn. Soc. Bot. **9**: 122. 1867; Guillaumin in Jour. Arnold Arb. **12**: 245. 1931; Christoph. in Bishop Mus. Bull. **128**: 104. 1935.

Viti Levu: Tholo North: Korovou, east of Tavua, alt. 60–150 m., *Degener 14942* (A) (vine, climbing over bushes and rocks in an isolated dry ravine; native name: *yaka;* root elongated, edible when cooked; stem used for tying temporary bundles). Kambara: *Smith 1268* (GH, NY) (vine, in thickets on limestone formation; petals rich pink).

Although it has been reported from the New Hebrides and from Samoa, among other Pacific groups, this widely distributed species is apparently new to Fiji.

OXALIDACEAE

Oxalis corymbosa DC. Prodr. **1:** 696. 1824.

Oxalis Martiana Zucc. in Denkschr. Akad. Muench. **9**: 144. 1824.

Viti Levu: Lautoka: Lautoka, *Greenwood 803* (GH) (in damp places about dwellings; flowers reddish purple).

This escape has not previously been reported from Fiji. The collector notes that it has appeared in the vicinity of Lautoka only during the past five years, but that he observed it in Suva about ten years ago.

LINACEAE

Durandea Planch. in Hook. Lond. Jour. Bot. **6:** 594. 1847; op. cit. **7:** 527. 1848; Stapf in Hook. Ic. Pl. **29:** *pl. 2822.* 1906; Stapf in Kew Bull. **1908:** 11–14. 1908; Winkl. in Engl. & Prantl, Nat. Pfl. ed. 2. **19a:** 108. 1931. *Nomen conservandum propositum.*

Durandea Planch. is herewith proposed for conservation over *Durandea* Delarb. (Fl. Auv. ed. 2. 365. 1800), a name which has been used in connection with only one binomial and which is apparently referable to *Raphanus* L. (Cruciferae). Sixteen binomials have been referred to *Durandea* Planch., and in order to preserve these the generic name should be added to the list of *nomina generica conservanda.*

Durandea vitiensis Stapf in Hook. Ic. Pl. **29:** sub *pl. 2822.* 1906; in Kew Bull. **1908:** 13. 1908.

Viti Levu: Serua: Near Mt. Ngamo, vicinity of Ngaloa, alt. 60 m., *Degener 15075* (A) (liana, in sunny forest; flowers dark yellow); Vatuvilakia, vicinity of Ngaloa, alt. 90 m., *Degener 15149* (A) (liana, in forest); Rewa: Vicinity of Suva, alt. 225 m., *MacDaniels 1161* (Bish) (scandent shrub, in rain-forest).

The rediscovery of this plant is of considerable interest, since it has previously been reported only from *Storck 4* (type coll., a duplicate being at GH), collected without definite locality and lacking fruits. The apparently nearly mature fruits of the Degener specimens are coriaceous, ellipsoid, up to 10 mm. long and 8 mm. broad, conspicuously 15-costate when dried, with 5 one-seeded bony pyrenes.

MELIACEAE

Dysoxylum pilosum sp. nov.

? *Dracontomelon pilosum* Seem. Fl. Vit. 52. 1865.

Arbor ad 8 m. alta, ramis ramulisque crassis subteretibus juventute densissime cinereo-pilosis (pilis simplicibus patentibus circiter 1 mm. longis) demum glabrescentibus; foliis pinnatis alternatis ad 70 cm. longis, petiolo ad 12 cm. longo basi incrassato et rhachi leviter canaliculata ut ramulis densissime pilosis; foliolis suboppositis vel basim foliorum versus alternatis (13–) 17–23, petiolulis subteretibus pilosis 2–5 mm. longis, laminis papyraceis falcato-oblongis, (4–) 9–15 cm. longis, (2–) 2.5–4.5 cm. latis, basi inaequaliter obtusis vel subrotundatis, apice obtuse cuspidatis, margine integris, supra praeter nervos interdum pilosos glabris, subtus pilis 0.4–0.6 mm. longis simplicibus densissime et persistenter molliter pilosis, costa supra subplana vel leviter canaliculata subtus valde elevata, nervis

secundariis utrinsecus 8–20 patentibus marginem versus obscure anastomosantibus supra subplanis vel insculptis subtus valde prominulis, rete venularum immerso; inflorescentiis completis sub anthesi non visis sed ut videtur thyrsoideo-paniculatis, ramulis lateralibus brevibus rugulosis molliter pilosis, bracteis bracteolisque oblongo-deltoideis acutis 0.5–1 mm. longis; floribus numerosis sessilibus, calyce cupuliformi, circiter 1.5 mm. longo, 2–2.5 mm. diametro, extus pilis patentibus circiter 0.15 mm. longis dense pallide piloso, intus glabro, profunde lobato, lobis 4 late ovatis, circiter 1 mm. longis, 1.2–2 mm. latis, apice rotundatis vel obtusis; petalis 4 extus pallide puberulis intus glabris, 5–6 mm. longis, 1–1.2 mm. latis, tubo circiter 1.5 mm. diametro cohaerentibus, apicem versus liberis et apice acutis et leviter incurvatis; filamentis connatis, tubo cylindrico petala subaequante, basim versus corollam adnato, apice crenulato, extus dense pilosulo, intus glabro, antheris 8 sessilibus oblongis circiter 0.8 mm. longis intra tubum apicem versus inclusis; disco glabro cylindrico circiter 2 mm. longo apice crenulato; gynaecio corollam fere aequante, ovario ellipsoideo cum basi styli dense hirsuto, loculis 4, stylo carnoso, stigmate incrassato-capitato; inflorescentiis sub fructu 8–13 cm. longis, ramulis incrassatis longe persistenter molliter pilosis, fructibus coriaceis subglobosis ad 15 mm. diametro (vel maturitate majoribus?) demum glabris et conspicue rugosis, basi obtusis, apice rotundatis, pericarpio duro tenui, seminibus 3 vel 4 angulari-ellipsoideis circiter 8 mm. longis et 5–6 mm. latis.

Viti Levu: Lautoka: Near Lautoka, *Greenwood 396* (A, TYPE, fl.), Aug. 28, 1922 (medium-sized tree); north of Lomolomo, alt. 90 m., *Degener & Ordonez 13715* (A, fr.) (coarse tree 8 m. high, on dry slope in a ravine of small jagged range of hills).

Dracontomelon pilosum Seem. is based upon a sterile specimen taken from a young plant. I remarked (in Bishop Mus. Bull. **141**: 87. 1936) that the two leaves of the type (*Seemann 100,* from Viti Levu) probably belong to a species of *Dysoxylum.* The more recent collections by Greenwood and Degener appear to bear out this supposition and I am reasonably sure that the plant here described as new is conspecific with *Dracontomelon pilosum.* This conclusion is based upon Seemann's description and my own recollection of the specimen at Kew. Nevertheless, since the Kew specimen cannot again be consulted at present, I am not prepared to say definitely that it is identical with my new species. I have deliberately used for this the same specific epithet which Seemann selected for his plant, so that, if future observation should verify my supposition, the transfer of the epithet from *Dracontomelon* to *Dysoxylum* will not be permissible and the Greenwood specimen will remain the type of the specific concept. Seemann describes his leaflets as being 5 pairs and about 6 cm. broad, but since his leaves were juvenile these observations may be of little value.

A member of the Section *Eudisoxylum, D. pilosum* resembles *D. Richii* (A. Gray) C. DC. in its inflorescence characters, differing only in the stouter flowers and the slightly denser pubescence of the petals. The new species is readily distinguished from *D. Richii* by the dense and persistent pubescence of the lower surfaces of its leaflets. In *D. pilosum* the pubescence of the inflorescence-branches persists in mature fruiting specimens, while in *D. Richii* the fruiting inflorescence is essentially glabrous. Both flowering and fruiting inflorescences of *D. pilosum* now available are considerably shorter than those of *D. Richii,* but this character may be of little consequence.

Dysoxylum myriandrum sp. nov.

Arbor 6 m. alta, ramulis crassis subteretibus rugosis juventute pilis simplicibus patentibus fuscis circiter 0.3 mm. longis densissime tomentosis demum glabratis; foliis pinnatis alternatis ad 40 cm. (vel ultra?) longis, petiolo ad 15 cm. longo supra complanato basi incrassato et rhachi ut ramulis primo densissime tomento-

sis; foliolis suboppositis 9–13, petiolulis gracilibus basi incrassatis 5–15 mm. longis ut ramulis tomentellis, laminis chartaceis vel subcoriaceis obovato-oblongis, 5.5–11 cm. longis, 3–5.5 cm. latis, basi inaequaliter obtusis, apice obtuse cuspidatis, margine integris et leviter recurvatis, supra glabris, subtus praeter costam et nervos secundarios primo dense et breviter strigosos glabris, costa supra subplana prominula subtus prominente, nervis secundariis utrinsecus 7–12 patentibus marginem versus obscure anastomosantibus supra leviter impressis subtus elevatis, rete venularum subimmerso; inflorescentiis completis non visis sed ut videtur paniculatis, rhachi ramulisque densissime et breviter pallido-pilosis, bracteis bracteolisque subcoriaceis late ovatis obtusis ad 1 mm. longis et 3 mm. latis extus sericeis intus glabris; pedicellis crassis (2.5–3 mm. diametro) 2–3 mm. longis cum calyce pilis circiter 0.2 mm. longis dense pallide sericeis; sepalis 5 ad basim liberis imbricatis subcarnosis late ovatis, 2–2.5 mm. longis, 3–4 mm. latis, intus glabris, apice rotundatis, obscure glandulosis; petalis 5 liberis carnosis imbricatis elliptico-oblongis, 9–11 mm. longis, 5–7 mm. latis, apice obtusis, extus ut sepalis dense sericeis, intus glabris; filamentis connatis, tubo libero carnoso cylindrico, 6–8 mm. longo, circiter 6 mm. diametro, apice crenulato, extus parce sericeo, intus glabro, antheris circiter 15 sessilibus oblongis circiter 2.5 mm. longis, basi et apice obtusis vel leviter emarginatis, intra tubum apicem versus inclusis; disco subcarnoso cylindrico circiter 2.5 mm. longo et 3 mm. diametro apice crenulato; gynaecio tubum subaequante, ovario conico pilis circiter 0.5 mm. longis dense stramineo-sericeo, loculis 5, stylo crasso carnoso, stigmate capitato circiter 2 mm. diametro.

VANUA LEVU: Thakaundrove-Mathuata boundary: Crest of Korotoni Range, between Navitho Pass and Mt. Ndelaikoro, alt. 650–900 m., *Smith 569* (GH, NY, TYPE), Nov. 21, 1933 (tree 6 m. high, in dense forest; petals and staminal tube pale green, brown-tinged; native name: *warokamithi*).

The cited specimen was originally distributed as *D. lenticellare* Gillespie, a species from which it is immediately distinguished by the pubescence of its leaf-rachis and the nerves of the lower surfaces of leaflets, as well as by its entirely different flowers. *Dysoxylum myriandrum* has no close relatives among species of the region, being characterized by the above-mentioned pubescence, the stout and densely sericeous flowers, and the unusually large number of stamens. To the best of my knowledge more than 10 stamens have not previously been reported in *Dysoxylum*, but on the basis of all its other characters the present species certainly belongs in that genus. In C. De Candolle's treatment of the genus (in DC. Monogr. Phan. 1: 480–528. 1878), *D. myriandrum* keys to those few species of the Section *Didymocheton* with the staminal tube free, but among them it seems to have no close relatives.

Aglaia vitiensis A. C. Sm. in Bishop Mus. Bull. **141**: 80. *fig. 41.* 1936.

Dysoxylum obliquum Gillespie in Bishop Mus. Bull. **83**: 13. *fig. 15* (excl. *a-e*). 1931; not *Aglaia obliqua* White & Francis (1927).

VITI LEVU: Tholo North: Vicinity of Nandarivatu, alt. 750–900 m., *Gillespie 3757* (GH), *4316* (GH, type coll. of *Dysoxylum obliquum*), *Degener 14334* (A), *14666* (A); Namosi: Mt. Naitarandamu, alt. 1000 m., *Gillespie 3105* (GH).

Gillespie's species *Dysoxylum obliquum* was based upon a confused concept. *Gillespie 4316,* indicated as the type, is a specimen with comparatively small leaflets and narrow curved fruits. I have not seen all the other specimens cited by Gillespie, but his cited no. *3757* is clearly *A. vitiensis,* as is his no. *3105,* which he does not cite. As to the type itself, I believe that this may be safely considered conspecific with the type of *A. vitiensis,* in spite of its rather smaller leaflets and differently shaped fruit. Gillespie remarks that the specimen selected as the type of *Dysoxylum obliquum* has smaller leaves than the other cited specimens. The

specific epithet cannot be used in *Aglaia* because of the earlier *A. obliqua* White & Francis.

Among the other specimens cited by Gillespie as *Dysoxylum obliquum,* his no. *4161* does not belong here (i.e. to *Aglaia vitiensis*) and I have referred it to the following new species. The situation is further complicated by the fact that the flowers which Gillespie described and figured as representing *Dysoxylum obliquum* were taken from *Horne 316.* This specimen was elsewhere and correctly referred to *Dysoxylum lenticellare* Gillespie. Thus three species in two genera were used in drawing up the original description of *Dysoxylum obliquum,* but the name itself need be considered only in connection with the type.

Aglaia vitiensis has previously been known from Koro, Vanua Levu, and Taveuni. Its occurrence at middle and high elevations on all the larger volcanic islands of Fiji is to be anticipated.

Aglaia axillaris sp. nov.

Arbor gracilis ad 5 m. alta, partibus juvenilibus dense ferrugineo-lepidotis (squamulis in ramulis, rhachibus, petiolulis, et costis saepe persistentibus), ramulis subteretibus demum cinereis; foliis pinnatis ad 55 cm. longis, petiolis 4–10 cm. longis basi incrassatis cum rhachi leviter canaliculatis; foliolis suboppositis 9–13, inferioribus minimis, petiolulis 4–13 (–22) mm. longis, laminis chartaceis siccitate fusco-olivaceis oblongis vel elliptico- vel ovato-oblongis, (7–) 10–18 (–25) cm. longis, 3.5–8 cm. latis, basi obtusis et interdum inaequalibus, apice obtusis vel rotundato-cuspidatis, utrinque praeter costam interdum lepidotam glabris, costa supra subplana subtus prominente, nervis secundariis utrinsecus 9–15 (–18) patentibus subrectis supra subplanis subtus valde prominulis, rete venularum immerso; inflorescentiis axillaribus sub anthesi 1–3 cm. longis anguste paniculatis paucifloris ubique densissime ferrugineo-lepidotis, pedunculo et rhachi crassis, bracteis oblongis obtusis 2–4 mm. longis, bracteolis similibus sed minoribus, pedicellis subnullis; calyce sub anthesi circiter 3 mm. longo et summo diametro, tubo cupuliformi, lobis oblongo-deltoideis obtusis circiter 1.2 mm. longis et latis; petalis subcarnosis concavis elliptico-obovatis, 2.5–3.5 mm. longis, 1.5–2 mm. latis, apice rotundatis, apicem versus obscure pellucido-punctatis, extus ut calyce lepidotis; staminibus glabris, tubo textura petalis simili subgloboso-cylindrico circiter 2 mm. longo, apice obscure crenulato, antheris intra apicem tubi sessilibus oblongis 0.8–1 mm. longis; ovario breviter cylindrico lepidoto, stigmate carnoso capitato circiter 1 mm. diametro; fructibus dense et arcte ferrugineo-lepidotis, primo anguste oblongo-ellipsoideis et subfalcatis mox globoso-ellipticis, maturitate ut videtur ad 3 cm. longis et 2 cm. diametro, pericarpio tenui, seminibus 1–3 oblongo-ellipsoideis nigrescentibus rugulosis.

Viti Levu: Tholo North: Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. 750 m., *Degener 14505* (A, type), Feb. 18, 1941 (slender tree 5 m. high, in dense forest; fruit orange-brown; native name: *sasawira*); Nauwanga, vicinity of Nandarivatu, alt. 750 m., *Degener 14689* (A) (small tree, in forest; native name: *mala*); vicinity of Nandarivatu, alt. 900 m., *Gillespie 4161* (GH).

Aglaia axillaris bears a superficial resemblance to *A. vitiensis* A. C. Sm., the two species being distinguished by the following characters:

Leaflets 9–13 (averaging 11); inflorescence short, not exceeding 3 cm. (averaging 1–1.5 cm.) in length at anthesis, very compact in fruit and often borne on defoliate branchlets; calyx-lobes oblong-deltoid, about 1.2 mm. long; filament-tube about 2 mm. long, the anthers included within it ..... *A. axillaris.*

Leaflets 5–9 (averaging 7); inflorescence loosely paniculate, up to 10 cm. long at anthesis, often shorter in fruit due to disarticulation, apparently associated with the leaves; calyx-lobes broadly ovate, about 0.7 mm. long; filament-tube about 1 mm. long, obviously exceeded by the anthers ..... *A. vitiensis.*

In addition, certain intangible characters can be used to separate the two species; *A. axillaris* has a tendency toward shorter petiolules and its distal leaflets tend to be narrower and more obviously oblong. The difference in staminal arrangement is such that the two species fall into different series, as these are generally recognized, *A. axillaris* into *Euaglaia* and *A. vitiensis* into *Hearnia*. Their similarity in other aspects indicates that they are more closely allied than this would indicate.

Aglaia Archboldiana sp. nov.

Arbor, ramulis crassis teretibus densissime ferrugineo-stellato-tomentosis (pilis multiramulosis, ramulis e pelta parva orientibus, nonnullis 0.7–1.3 mm. longis, reliquis brevissimis, omnibus demum saepe descitis, pelta persistente et ut videtur multiciliata); foliis pinnatis ad 60 cm. longis, petiolis 12–18 cm. longis basi incrassatis cum rhachi subteretibus ut ramulis dense stellato-tomentosis; foliolis oppositis vel subalternatis plerumque 7 raro 5, petiolulis tomentosis leviter canaliculatis crassis, lateralibus 7–15 mm. longis, laminis chartaceis elliptico- vel obovato-oblongis, (10–) 15–25 (–35) cm. longis, 5–10 (–14) cm. latis, basi obtusis et interdum inaequalibus, apice cuspidatis vel breviter acuminatis, margine integris vel undulatis et leviter recurvatis, supra glabris vel in sulcula costae obscure tomentellis, subtus pilis ut eis ramulorum densissime tomentosis, costa supra leviter canaliculata subtus prominente, nervis secundariis utrinsecus (12–) 15–25 rectis patentibus marginem versus abrupte curvatis supra subplanis vel leviter insculptis subtus valde elevatis, rete venularum immerso vel subtus prominulo; inflorescentiis apicem ramulorum versus axillaribus anguste paniculatis sub anthesi ad 4 cm. (vel ultra?) longis paucifloris ubique dense stellato-tomentellis (pilis ut eis ramulorum ad 1 mm. longis plerumque brevioribus), pedunculo brevi et rhachi crassis, bracteis lineari-oblongis ad 4 mm. longis; floribus sessilibus vel breviter pedicellatis, pedicellis crassis sub anthesi articulatis, bracteolis sub anthesi 3 vel 4 lineari-lanceolatis 2–4 mm. longis; calyce cupuliformi sub anthesi circiter 3.5 mm. longo et summo diametro, lobis ovato-deltoideis subacutis circiter 1.2 mm. longis et 2 mm. latis intus glabris; petalis subcarnosis concavis utrinque glabris elliptico-oblongis, circiter 2 mm. longis, 1.2–2 mm. latis, forsan maturitate majoribus, margine anguste scariosis; staminibus glabris 1.5–2 mm. longis, filamentis in tubo crasse carnoso 1–1.5 mm. longo connatis, antheris inflexis in margine tubi sessilibus deltoideo-oblongis circiter 0.8 mm. longis; ovario breviter cylindrico dense stellato-tomentello, basi stylorum conico glabro, stylis 2 apice distinctis; inflorescentiis sub fructu ad 10 cm. longis, tomento longe persistente, ramulis pedicellisque valde incrassatis, sepalis persistentibus; fructibus dense et arcte ferrugineo- vel cinnamomeo-stellato-tomentellis, maturitate elliptico-subglobosis 2–3 cm. diametro, pericarpio tenui, seminibus 2–4 complanato-ellipsoideis siccitate valde rugulosis.

Viti Levu: Serua: Vicinity of Ngaloa, *Degener & Ordonez 13705* (A, type), Nov. 29, 1940 (tree, in forest); Tholo North: Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. 750 m., *Degener 14506* (A) (tree, in dense forest; fruit light brown; native name: *sasawira*).

Aglaia Archboldiana is readily distinguished from other Fijian species by the long stellate tomentum of its leaves, inflorescence-branches, and calyces. In the type collection, bearing quite mature fruits, this tomentum persists. The second specimen cited is still more mature, and here the tomentum is reduced to scattered (but still profuse) stellate hairs with frequently broken branches. Other Fijian species which have this type of tomentum to a limited extent are *A. basiphylla* A. Gray, *A. Greenwoodii* A. C. Sm., and the following new species, but these all have small leaflets and small fruits and are only very distantly related to *A.*

Archboldiana. A species of the Section *Hearnia, A. Archboldiana* resembles *A. vitiensis* A. C. Sm. in its staminal characters, but otherwise the two species are not closely related.

Aglaia fragilis sp. nov.

Arbor gracilis 3 m. alta, ramulis teretibus juventute pilis circiter 0.5 mm. longis densissime ferrugineo-stellato-tomentellis demum cinereis glabrescentibus; foliis pinnatis raro unifoliolatis ad 15 cm. longis, petiolis 1–3 cm. longis cum rhachi gracilibus subteretibus ut ramulis tomentellis; foliolis suboppositis 3 vel 5 (raro ad 1 reductis), petiolulis tomentellis subteretibus lateralibus 2–3 mm. longis terminalibus longioribus, laminis chartaceis vel papyraceis anguste elliptico-oblongis, 3–8 (terminalibus ad 11) cm. longis, 1.5–3.3 cm. latis, basi obtusis vel rotundatis, apice obtusis, margine integris et leviter recurvatis, supra glabris, subtus pilis ut eis ramulorum persistenter pilosis, costa supra leviter canaliculata subtus prominente, nervis secundariis utrinsecus 5–8 in foliolis lateralibus (12–16 in foliolis terminalibus) rectis marginem versus obscure anastomosantibus supra subplanis subtus prominulis, rete venularum obscuro; inflorescentiis axillaribus laxis paniculatis sub anthesi ad 7 cm. longis ubique dense stellato-tomentellis (pilis ad 0.5 mm. longis plerumque minoribus), pedunculo brevi et ramulis gracilibus, bracteis oblongis circiter 1 mm. longis, bracteolis minoribus, pedicellis gracilibus 2–5 mm. longis; calyce fere ad basim lobatis, lobis submembranaceis anguste oblongis obtusis, circiter 1.5 mm. longis et 0.6 mm. latis, intus glabris; corolla subglobosa, petalis subcarnosis concavis oblongo-ellipticis, 2–2.5 mm. longis, 1–1.5 mm. latis, apice rotundatis, extus dense stellato-pilosis vel sublepidotis, intus glabris; staminibus circiter 1.5 mm. longis glabris, filamentis in tubo crasse carnoso 1–1.2 mm. longo connatis, antheris inflexis in margine tubi sessilibus deltoideo-oblongis circiter 0.7 mm. longis; ovario ellipsoideo-ovoideo sub anthesi circiter 0.7 mm. longo dense stellato-puberulo, columna stylorum glabra ovarium subaequali apicem versus incrassata, stigmatibus obscuris.

Viti Levu: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. about 750 m., *Degener 14680* (A, type), Mar. 6, 1941 (leafy tree about 3 m. high, in forest).

Aglaia fragilis is very distinct among Fijian species, characterized by the conspicuous and apparently persistent pubescence of its inflorescences, lower surfaces of leaflets, etc., by its lax and ample inflorescences, and by the fact that its few lateral leaflets are conspicuously smaller than the terminal one. A member of the Section *Hearnia,* it suggests by its pubescence *A. Greenwoodii* A. C. Sm., but that species has soon glabrescent leaflet-blades, usually 7–9 subequal leaflets, and a very compact inflorescence with much shorter pedicels.

POLYGALACEAE

Polygala paniculata L. Amoen. Acad. **5:** 402. 1759; Setchell in Carnegie Inst. Publ. **341:** 79. 1924; Christoph. in Bishop Mus. Bull. **128:** 117. 1935.

Viti Levu: Tholo North: Nandarivatu, alt. about 800 m., *Degener & Ordonez 13540* (GH) (garden weed), *Reay 24* (GH); Sovutawambu, near Nandarivatu, alt. 750 m., *Degener 14591* (GH) (very common among grasses and weeds); Nandronga: Singatoka River, *Greenwood 461B* (GH) (common on dry hillsides); Rewa: Suva, *Degener & Ordonez 13511* (GH) (in clay near shore, along roadside); Naitasiri: Nasinu, alt. 150 m., *Gillespie 3420* (NY) (common weed). Kandavu: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 103* (NY) (common on edge of forest).

The lack of older collections indicates that this common weed is probably of recent introduction in Fiji. Although the species is known from other Pacific groups, I believe this to be the first record of the family from Fiji.

EUPHORBIACEAE

By L. Croizat

Phyllanthus urinaria L. Sp. Pl. 982. 1753; Muell. Arg. in DC. Prodr. **15**(2): 364. 1866; Benth. Fl. Austr. **6**: 102. 1873; Hook. f. Fl. Brit. Ind. **5**: 293. 1887; Merr. in Philip. Jour. Sci. Bot. **9**: 105. 1914; Kaneh. in Jour. Dept. Agr. Kyushu Univ. **4**: 354. 1935.

Viti Levu: Tholo North: Nandarivatu, *Greenwood 789A* (A).

The species, which is here first recorded from Fiji, is probably more common in the Pacific than literature indicates. It is easily separated from all other herbaceous species of *Phyllanthus* (e.g. *P. Niruri* L.) by its muricate or papillose capsules, sessile flowers, angled stems, and sharp primaries. The leaf often has a peculiar metallic texture.

Glochidion amentuligerum (Muell. Arg.) Croizat, comb. nov.

Phyllanthus amentuliger Muell. Arg. in Linnaea **48**: 390. 1865; in DC. Prodr. **15**(2): 313. 1866; Seem. Fl. Vit. 219. 1867.

Vanua Levu: Thakaundrove: Eastern drainage of Yanawai River, *Degener & Ordonez 14115* (A); Natewa Bay region, *Smith 1926* (GH).

Glochidion amentuligerum is close to *G. anfractuosum* Gibbs, but has the lower leaf-surface manifestly glaucescent or grayish and the veins fairly thickly puberulent under a lens; *G. anfractuosum* is not glaucescent and is very sparingly hairy at the midrib with very short substrigose trichomes.

Glochidion Gillespiei Croizat, sp. nov.

Glochidion Manono sensu Gillespie in Bishop Mus. Bull. **91**: 16. *f. 17.* 1932; non Baill.

Arbuscula glabra; foliis 7–11 cm. longis, 3–5.5 cm. latis, cuspidato-lanceolatis vel ovato-cuspidatis subtus glaucescentibus, nervis totis conspicuis; inflorescentiis axillaribus cymulosis; perianthio ♂ ca. 2 mm. longo, 2–4 mm. fauce lato, lobis 6 late imbricatis; perianthio ♀ 3 mm. longo, lobis 6 erectis valde costatis, interdum anisomeris ca. 3 mm. longis, pedicello 2–3 mm. longo, stylo valido clavato ad 5 mm. longo apice subtrifido, stigmatibus haud patentibus; ovario ut videtur 3-loculari.

Viti Levu: Namosi: Naitarandamu Mt., summit, alt. 1200 m., *Gillespie 3161* (GH, TYPE), Sept. 1927.

Gillespie's illustration of this new species, under the name of *G. Manono,* is excellent. *Glochidion Manono* Baill. (as represented by *Lépine 210* and *U. S. Expl. Exped.*) is an altogether different plant, despite the similarity of the descriptions. I have seen no authentic Fijian records of *G. Manono* and believe that the record based upon the cited Exploring Expedition collection is an error, because Baillon's species, either in its typical form or its varieties, is apparently not found west of Samoa. Gillespie (l. c. 16) suggests that the extraordinary development of the stylar column of his plant is probably due to the parasitism of a fungus. This is not likely to prove correct, as many species of *Glochidion* (e.g. *G. Daltonii* Kurz) have a style fully as well developed as that of *G. Gillespiei.*

Glochidion calciphilum Croizat, sp. nov.

Arbuscula vel frutex contortus 1-metralis, innovationibus fere glabris, i.e. pilis perpaucis hic inde ad apicem obsitis, cortice griseo vel olivaceo-brunneo levi; foliis totis pallescentibus firme chartaceis subconcoloribus dimorphicis, aliis eximie rotundatis vel obovato-rotundatis apice subtruncato-rotundatis ad 2 cm. longis latisque, aliis ellipticis vel lanceolato-ellipticis, interdum falcatis basi anisomeris, 4–7 cm. longis, 2–4 cm. latis, venis primariis utrinque ca. 4–5-jugis, petiolo ruguloso ca. 0.5 cm. longo; stipulis triangularibus parvis margine sub lente acri interdum ciliatulis; inflorescentiis axillaribus ut videtur paucifloris; flore ♂: peri-

anthio ca. 2 mm. longo et lato extus puberulo, pedicello gracili ca. 4 mm. longo, lobis 6 oblanceolatis valde costatis ca. 1.5 mm. longis, 0.75 mm. latis, columna staminali 3-antherifera ad 1 mm. longa; flore ♀: perianthio puberulo arcte cyathiformi ad 2 mm. longo, lobis 5 vel 6 interdum leviter anisomeris ciliatulis obovato-ellipticis, 0.75–1.25 mm. longis, 0.75–0.5 mm. latis; ovario glaberrimo depresso-globuloso ca. 1 mm. magno, columna stylari pro ovarii magnitudine valida ad 1 mm. longa ellipsoidea, stigmatibus 5 apice liberis leviter divaricatis glaberrimis; fructu ca. 2 cm. lato et 1 cm. longo ut videtur 7- vel 8-loculari glabro.

KAMBARA: *Smith 1279* (GH) (compact shrub 1 m. high, on bare limestone; native name: *molau*). FULANGA: *Smith 1217* (GH, TYPE), Feb. 26, 1934 (gnarled tree 1 m. high, on lagoon cliff in limestone formation).

The structure of the stylar column readily separates this species from *G. concolor* Muell. Arg. The long and slender pedicel of the pistillate flower is unlike that of *G. amentuligerum* (Muell. Arg.) Croizat and *G. anfractuosum* Gibbs. The material at hand is not sufficient to establish the affinities of the new species, but it is not related to *G. Manono*.

Glochidion concolor Muell. Arg. in Linnaea **32**: 62. 1863; Seem. Fl. Vit. 219. 1867.
Phyllanthus concolor Muell. Arg. in DC. Prodr. **15**(2): 290. 1866.

This binomial has been disregarded since 1867 and its reinstatement demands a brief comment. *Harvey s. n.* (in 1855), an isotype of *G. concolor,* is very close to *Gillespie 4412* and *Degener 14298, 14587,* and *15164,* all from Fiji, and it cannot definitely be separated from a specimen of *Parks 16030* from Eua, Tonga. Some of these specimens have been identified in herbaria as *G. ramiflorum* Forst. f., and the evidence from the literature indicates that they indeed answer the concept of that species held by writers on the Pacific flora.

Whether these specimens are ultimately to be treated under *G. concolor* or *G. ramiflorum* cannot be decided at present, because the type material of Forster's species is probably a mixture of two or more species. The later record of the species does not include a description, merely referring to the diagnosis and figures of the generic description, which is unsatisfactory for specific identification. The type localities are two under the technical publication of the binomial, the Society Islands and the New Hebrides, but only one, Tanna, is later indicated (Forst. f. Fl. Ins. Austr. Prodr. 92. 1786). Thus, Tanna should be accepted as the *locus classicus*.

It is probable that *G. tannaense* Guillaumin (in Jour. Arnold Arb. **13**: 90. 1932) is actually the same as the Tanna specimen of *G. ramiflorum;* Guillaumin (l. c.) remarks, "Could this be the *Glochidion* sp. found on Tanna by Forster?" The type collection of *G. tannaense* differs but slightly, if at all, from certain pubescent forms of the Fijian plant. Mueller Argoviensis typifies *G. ramiflorum* (as *Phyllanthus ramiflorus* var. *genuinus,* in DC. Prodr. **15**(2): 289. 1866) with reference to the Forster specimen from the Societies and not the one from the New Hebrides. To judge by a specimen verified by Mueller himself, it is not improbable that he understood as *P. ramiflorus* var. *genuinus* the entity from Raiatea published as *G. emarginatum* by Moore (in Bishop Mus. Bull. **102**: 30. 1933).

In view of the constant confusion of various plants under the name *G. ramiflorum,* the following outline of distribution is suggested pending a critical study of the entire genus in the Pacific:

(1). *Glochidion ramiflorum* is typified by a plant from Tanna, which is probably conspecific with that described by Guillaumin as *G. tannaense*. This species

is very close to that of Fiji and may be conspecific with *G. concolor* Muell. Arg. The complex of *G. ramiflorum* may extend as far east as Tonga.

(2). Mueller Argoviensis errs in typifying *G. ramiflorum* with reference to a plant from the Societies. This plant is apparently close to *G. Manono* and may prove to be the same as *G. emarginatum*.

(3). In the present state of our knowledge, the range of *G. ramiflorum* cannot be extended east of Samoa, and it is doubtful whether Forster's species occurs eastward beyond Tonga.

Glochidion marquesanum (F. Brown) Croizat, comb. nov.

Glochidion ramiflorum var. *marquesanum* F. Brown in Bishop Mus. Bull. **130**: 144. *f. 22, a-e.* 1935.

This new combination should not be delayed, in view of the above discussion. Brown's entity has certainly little to do with the Tanna material of Forster, and hardly anything in common with the material from the Societies mistakenly used by Mueller to typify Forster's concept.

Breynia disticha Forst f. var. **typica** Muell. Arg. f. **nivosa** (W. G. Smith) Croizat, comb. nov.

Phyllanthus nivosus W. G. Smith in Flor. Mag. n. s. **13**: *pl. 120.* 1874; Sherff in Field Mus. Publ. Bot. **17**: 568. 1939.

Phyllanthus roseo-pictus Hort. ex Reg. in Gartenfl. **28**: 19. 1879.

Breynia nivosa Small in Bull. Torrey Bot. Club **37**: 516. 1910; Setch. in Univ. Cal. Publ. Bot. **12**: 187. 1926; Wilder in Bishop Mus. Bull. **86**: 66. 1931; Christoph. in Bishop Mus. Bull. **128**: 120. 1935; F. Brown in Bishop Mus. Bull. **130**: 137. 1935.

Breynia nivosa var. *roseo-picta* F. Brown in Bishop Mus. Bull. **130**: 137. 1935.

Breynia J. R. & G. Forst. is illegitimate on two counts. It is a later homonym of *Breynia* L. (Sp. Pl. 503. 1753) and a *nomen confusum*, a mixture of *Breynia* sp. and *Phyllanthus distichus* L., which was rejected by both A. de Jussieu (Tent. Euph. 22. 1824) and Baillon (Et. Gén. Euph. 633. 1858). Consequently *Breynia* J. R. & G. Forst. is here retained as a *nomen genericum conservandum propositum*. If its conservation is not upheld, the valid name will be *Melanthes* Bl. (corrected from *Melanthesa* Bl. in Bl. & Fisch. Fl. Jav. **1**: vii, *in not.* 1828). It should be noted that *Melanthes* already has legitimate status in nomenclature as *Breynia* Sect. *Melanthes* [*Melanthesa*] Baill. (in Adansonia **6**: 344. 1866).

The reduction of *Breynia* under *Phyllanthus* as proposed by Sherff hardly deserves mention, as the two genera are distinct and have so been treated for over a century.

Abundant material of *B. disticha* var. *neocaledonica* Muell. Arg. is available for comparison (*Vieillard 1195, Franc 1645, 1645a,* and *2117*). The foliage of this plant is usually smaller than that of the Snowbush Breynia, but all other characters are practically the same in the two entities. Thus it appears most probable that this well known ornamental belongs to var. *genuina*, of which it is a form verging on the *lusus*, the variegations of the leaves changing endlessly even on the same plant. The possibility that the Tongatabu specimen of *B. oblongifolia* cited by Mueller Argoviensis (in DC. Prodr. **15**(2): 440. 1866) might belong to *B. disticha* is not to be excluded, since a specimen of the Snowbush Breynia, *Wood 1159* (A), exhibits some long and narrow leaves which appear to match the foliage of *B. longifolia*.

The plant upon which W. G. Smith described and figured *P. nivosus* is stated in the publication to have come from the New Hebrides and to have been culti-

vated by W. Bull of Chelsea, England. The parenthetic authorship "Bull." or "Bulliard," given by various authors, is an error.

The new combination is exemplified by the following material: *Degener & Ordonez 13667* (A) and *Greenwood 727B* (A) from Viti Levu, Fiji, *Jack 4425* (A) from Cuba, and *Croizat* (A).

Drypetes vitiensis Croizat, sp. nov.

Arbor 6-metralis, innovationibus adultioribus atro-brunneis conferte albido-lenticellatis, apice parcius hispidulis glabratisve subtus glaberrimis; foliis more generis in sicco olivaceo-discoloribus, firme chartaceis, glaberrimis, integerrimis, oblongo-ellipticis vel ovato-ellipticis, apice latissime acuminatis vel subrotundatis, basi rotundatis leviter anisomeris, 3–7 cm. longis, 2–5 cm. latis, venis gracilibus et subtus perspicuis late patentibus vel adscendentibus saepius furcatim anastomosantibus, ca. 5–7-jugis, venulis irregulariter reticulatis valde delicatis subobscurisve, petiolo ruguloso 10–15 mm. longo; stipulis obsoletis; fructu tantum viso: pedicello 5–7 mm. longo lenticellato saepius rigidulo porrecto, perianthio sub fructu elobato vix 2 mm. lato, fructu immaturo habitu subbaccato olivaceo, pilis albidis paucis ad basim induto, caeterum glabro, ad 15 mm. longo et 7 mm. crasso, stylis nigro-brunneis 2–3 depressis, more generis vix 1.5 mm. longis latisque.

Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15430* (A, TYPE), June 3, 1941 (in dry forest; fruit red; native name: *meme*).

I know of no other species with which this may be compared. The genus *Drypetes* is emphatically suggested by the characters of the fruit and the placentation. Prof. I. W. Bailey, who has kindly studied the wood of this plant, reports that its structure in all probability indicates that a species of *Drypetes* is represented. The genus is new to Fiji. A peculiarity worthy of note is the presence of a pair of glands near the hilum on the aril of the immature seed.

Claoxylon parvicoccum Croizat, sp. nov.

Arbuscula patens 4–10 m. alta; innovationibus parcius puberulis; foliis in sicco subconcoloribus olivaceis, junioribus interdum hic inde vinosis, ovato- vel obovato-ellipticis glabris vel glabratis, apice breviter acuminatis, basi longe cuneatis vel cuneato-rotundatis, margine sub lente crenato-denticulatis vel glanduloso-dentatis, 7–17 cm. longis, 3–9 cm. latis, venis adscendentibus ca. 5-jugis anastomosantibus valde obscuris; petiolo herbaceo puberulo 2–6 cm. longo, saepius vinoso, apice glandulis 2 sat inconspicuis ornato; stipulis glandulosis parvis; inflorescentiis spicatis vel subracemosis, gracilibus ad 8 cm. longis; perianthio ♂ ca. 4 mm. magno, pedicello 1 mm. longo, lobis 3 ca. 2 mm. longis et 1 mm. latis, staminibus ca. 25–35; perianthio ♀ ca. 1 mm. longo et 2 mm. lato, pedicello articulato vix 0.8 mm. longo, petalis 3 ovato-rotundatis ca. 0.3 mm. magnis, sepalis totidem ac petalis ca. 1 mm. longis et 1.5 mm. latis rotundatis; ovario perianthium longe excedente, parte ejus libera 1–1.5 mm. longa, ca. 2 mm. lata, stylis 3 minimis vix 0.25 mm. longis.

Koro: Eastern slope of main ridge, alt. 200–300 m., *Smith 1005* (GH) (tree 10 m. high, in forest). Vanua Levu: Mbua: Southern portion of Seatovo Range, alt. 100–350 m., *Smith 1520* (GH) (spreading tree 4 m. high, at edge of forest; native name: *vakatharendavui*); Thakaundrove: Maravu, vicinity of Salt Lake, *Degener & Ordonez 14172* (A). Taveuni: Vicinity of Wairiki, alt. 200 m., *Gillespie 4641* (GH, TYPE), Feb. 1928.

TONGA: Eua: Old Parker plantation, *Parks 16262* (A).

Gillespie has pertinently pointed out (in Bishop Mus. Bull. **91**: 14. 1932) that the characters of the staminate flower used by Mueller and by Pax and Hoffmann to key out the sections and species of *Claoxylon* are not reliable. Not all the genera of the Euphorbiaceae can be identified on the basis of pistillate flowers (e.g. *Phyllanthus,* which usually proves unworkable when staminate flowers are

lacking), but *Claoxylon,* like *Croton,* is clearly to be worked out first and foremost on the pistillate structures. Speciation by alterations taking place in the pistillate flower seems to be as widespread and as definite in *Claoxylon* as it is in *Croton.*

Claoxylon vitiense Gillespie is an excellent species, with essentially oblong leaves that are much longer than broad and with the young parts thickly velutinous, the indument being generally brownish. The leaves tend to be softly pubescent beneath and the styles are well-developed in relation to the size of the ovary, papillose, and spreading-recurved. Gillespie's illustration (in Bishop Mus. Bull. **91**: *f. 14.* 1932) of the habit fails to convey the impression which is gathered from such specimens as *Gillespie 2600* (GH), *2999* (GH), and *3280* (GH), *Degener & Ordonez 13770* (A), and *Degener 15203* (A), all from Viti Levu. *Claoxylon fallax* Muell. Arg. is also a good species, as represented by *Seemann 394* (GH) and *Tabualewa 15598* (A), with a rather thinly velutinous new growth and leaves tending to be ovate to obovate, on the whole perhaps a trifle larger than those shown by Gillespie in his illustration of *C. vitiense,* but otherwise very much like them. It appears to be very difficult, if indeed possible, on the basis of foliage to distinguish between certain states of the species and of *C. fallax.* Gillespie is probably correct in treating as *C. fallax* such specimens as *Gillespie 3477* and *3565; Gillespie 2213,* in fruit, seems also to belong here.

Claoxylon parvicoccum differs from *C. fallax,* with which it can easily be confused at a first glance, in the following features: (1) the ovary is about 3 mm. broad and the style not less than 2 mm. long in *C. fallax* (interpreted from *Tabualewa 15598*), while the ovary in *C. parvicoccum* is only 2 mm. broad and the styles barely 0.25 mm. long; (2) the ovary is heavily hispidulous and light yellow in *C. fallax,* sparingly setulose and wine-colored or pink in *C. parvicoccum;* (3) the perianth-lobes (sepals) are broadly ovate to triangular and more or less acuminate in *C. fallax,* nearly transversely oblong and much rounded in *C. parvicoccum;* and (4) the petals are much smaller by comparison with the sepals in *C. fallax* than they are in *C. parvicoccum.* These characters, taken jointly, manifestly separate the pistillate flowers of the two species. The Tonga record cited above is established on poor material and requires further confirmation.

Claoxylon Archboldianum Croizat, sp. nov.

Frutex vel arbuscula; innovationibus valde herbaceis, apice summo glabrescentibus vix setulosis; foliis in sicco olivaceis vel vinoso-olivaceis, 5–10 cm. longis, 2–4.5 cm. latis, lanceolatis vel ovato-lanceolatis vel oblanceolatis, apice acuminatis, basi cuneatis, margine plus minusve repandulo-dentatis, supra glabris subtus glabratis glabrisve, venis adscendentibus ca. 5-jugis; petiolo 1–4 cm. longo, ad laminae radicem ipsam glandulis 4 antice instructo; stipulis glandulosis subnullis; inflorescentiis gracilibus spicatis ad 4 cm. longis; floribus ♂ ignotis; floribus ♀: perianthio 2.5 mm. lato, 1 mm. longo, pedicello articulato cum pedunculo ca. 2.5 mm. longo, lobis 3 late triangularibus ad 2 mm. latis et 1 mm. longis, apice acutato saepius subcallosis, petalis nullis at disco hypogyno glanduloso inter lobos petali modo incrassato; ovario pyramidato vix setuloso ca. 1.5 mm. longo, stylis 3 patentibus papillosis ad 1 mm. longis integris; capsula fragili tricocca vinosa glabrata ad 3 mm. longa et 5 mm. lata, semine subgloboso-compresso ca. 3 mm. magno, arillo tenui vinoso, testa valde rugoso-asperata.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 750–900 m., *Degener 14906* (A, type), Mar. 26, 1941. Vanua Levu: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, probably only in part).

At first sight it is easy to mistake *C. Archboldianum* for *C. echinospermum,* but the new species differs from Mueller's entity (based on *U. S. Expl. Exped.* from Ovalau) in having leaves which are much more deeply repand-serrate, petals which are replaced by glands fusing with the disc, a less definitely trigonous fruit with blunter keels, and the epicarp practically glabrous (very sparingly setulose under a lens) and of a vinous color rather than appressed-velvety-setulose and yellow. In addition, the seed of *C. Archboldianum* is merely rugose, while it is definitely asperate in *C. echinospermum.* These differences point to entities which are not conspecific, showing that *Claoxylon,* like *Croton,* speciates mainly in the pistillate flower and the fruit.

Claoxylon sitibundum Croizat, sp. nov.

Arbuscula 3–5 m. alta; innovationibus parcius setulosis in ramos graciles cicatricosos abeuntibus; foliis in sicco brunneis vel olivaceis glabris, costa venisque interdum vinosis, 4.5–7 cm. longis, 2–3 cm. latis, lanceolatis vel oblanceolatis, habitu verticillatis, apice plus minusve acuminatis, basi longe cuneatis, margine repando-dentatis, venis sat obscuris adscendentibus ca. 6-jugis; petiolo 1–1.5 cm. longo setuloso vel glabrato vinoso canaliculato in laminam confluente, apice antice denticulis vel glandulis 2–4 ornato; stipulis triangularibus minutis; inflorescentiis simplicibus spicatis 4 cm. longis vel brevioribus; floribus ♂ ignotis; floribus ♀: perianthio 3-lobato, ca. 0.75 mm. longo et 1.5 mm. lato, lobis triangulari-ovatis costulatis, petalis saturate vinosis subnigris vel nigris, late rotundatis, lobis subaequilongis; ovario globuloso nigricanti parcissime setuloso ca. 1.5 mm. magno, vix tertio infero in perianthio incluso, stylis 3 nigricantibus revolutis vix 0.5 mm. longis; capsula nigricanti ca. 3.5 mm. lata et 2.5 mm. longa, seminibus complanatis, ambitu rotundatis, arillo nigricanti vel saturato-vinoso, ca. 2.5 mm. latis, vermiculato-rugosis.

Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15460* (A, type), June 6, 1941 (in dry rocky forest).

This is another species which can easily be confused with *C. echinospermum* and *C. Archboldianum,* of which it suggests a depauperate form with slender branchlets and verticillate leaves. It differs from the former in the small blackish capsule, the short inflorescence bearing usually a single apical pistillate flower, the smaller and differently sculptured seed, and in every detail of the perianth. It can be separated from *C. Archboldianum* by the smaller lenticular seed, the shape of the perianth-lobes, the presence of petals rather than glands in the flower, the inflorescence, and the leaves, which are broader in relation to their length.

A group of species of close relationship, with a range extending from the Dutch East Indies to Polynesia, contains *C. echinospermum* Muell. Arg., *C. taitense* Muell. Arg., *C. erythrophyllum* Miq., *C. affine* Zoll., *C. samoense* Pax & Hoffm., *C. Archboldianum* Croizat, and *C. sitibundum* Croizat.

Cleidion Degeneri Croizat, sp. nov.

Frutex vel arbuscula 2-metralis, innovationibus adpresse griseo-setulosis, citissime glabris, cortice griseo vel griseo-brunneo, cicatricibus foliorum delapsorum bene notato; foliis tenellis subtus praesertim parcius hispido-setulosis mox glabratis vel glabris, in sicco atro-olivaceis vel olivaceo-discoloribus, lanceolatis vel elliptico-lanceolatis chartaceis, apice brevius acuminatis, acumine mucronulato, basi plus minusve truncato biauriculatis, margine ratione varia dentato-serratis vel obscure serratis, serraturis incurvis glandulosis, 3–10 mm. inter se distantibus, 6–12 cm. longis, 2–5 cm. latis, venis adscendentibus ca. 7-jugis; inflorescentiis ♂ simplicibus habitu spicatis, ad 7 cm. longis, gracilibus, ♀ cymosis vel subpanicu-

latis, pedunculo communi gracillimo axillari ad 4 cm. longo, pedicellis ca. 5–10 subcapillaceis ad 1.5 cm. longis; floribus ♂ in cymis plurifloris congestis, perianthio ut videtur 3-lobato ad 3 mm. longo et lato, pedicello 1.5 mm. longo, staminibus ultra 20 pulvinatim aggregatis; floribus ♀: perianthio 3-fido in pedicellum more generis abeunte, lobis subsetaceis 2–3 mm. longis, puberulis glabratisve, ovario ut videtur 3-loculari ca. 1.5 mm. magno minute griseo-puberulo levi, stylis 3 habitu lentis, basi 0.3 mm. connatis, dein partitis, cruribus subulatis integerrimis, puberulo-papillosis, colore plus minusve vinosis, ad 14 mm. longis, fructu immaturo capsulari ad 4 mm. longo et 7 mm. crasso, levi, coccorum dorso plus minusve costulato.

Viti Levu: Tholo North: Vicinity of Tavua, alt. 30–150 m., *Degener 14962* (A) (shrub 1–2 m. high, in isolated dry forested ravine; fruit whitish); Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15505* (A); Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15570* (A, TYPE), June 17, 1941 (shrub or small tree 2 m. high).

Of this genus, only *C. Vieillardii* Baill. var. *vitiense* Muell. Arg. has thus far been reported from Fiji. I do not know whether *C. Degeneri* is the same as Mueller's variety, but it is certainly not conspecific with *C. Vieillardii*. The descriptions of *C. verticillatum* Baill., which Däniker (in Viert. Nat. Forsch. Gesell. Zürich **77** (Beibl. 19): 224. 1932) reports from the Loyalty Islands, and of *C. Vieillardii* var. *marcense* Guillaumin (in Sarasin & Roux, Nov. Caled. Bot. 166. 1920), from New Caledonia, do not suggest the characters of *C. Degeneri*. *Cleidion* is abundant in New Caledonia, but it does not seem to be represented elsewhere in Oceania except by scattered species of restricted range.

Trigonostemon (?) **voratus** Croizat, sp. nov.

Arbor videtur vel frutex validus, innovationibus pube sordide albicanti primum adpresse puberulis mox glabratis insigniter cicatricosis; foliis obovato-lanceolatis firme chartaceis, in sicco olivaceo-griseis, subtus pallidioribus, ca. 25 cm. longis et 13 cm. latis, glabris, apice breviter acuminatis vel rotundato-acuminatis fere e medio deorsum gradatim cuneatis, margine integerrimis, venis primariis modice adscendentibus sub margine ipso anastomosatis ca. 10–12-jugis, venulis supra quam subtus magis obviis, gracillimis, crebris, petiolo herbaceo 5–7 cm. longo, puberulo; stipulis valde obscuris; inflorescentiis axillaribus 12–14 cm. longis totis hispido-pubescentibus subherbaceis vel herbaceis, in apice sub floribus bracteis foliaceis, notis totis cum foliis ipsis congruentibus at valde minoribus ornatis, bracteis ad 4 cm. longis et 1.5 cm. latis; pedicellis articulatis ad 2–3 mm. longis validiusculis, pedunculis ut videtur simplicibus bracteolatis; perianthio ca. 15 mm. lato 5-mero, lobis ovatis vel ovato-lanceolatis nervosis, ad 5 mm. longis et 4 mm. latis, margine interdum parcissime et grosse dentato-lobatis, disco ut videtur nullo; ovarii reliquiis hispido-tomentosis.

Viti Levu: Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15569* (A, TYPE), June 17, 1941.

The cited collection is represented by many duplicates, but not a single flower has escaped the attacks of insects; the young fruit has all been devoured but for traces left at the bottom of the perianth. *Trigonostemon* has not previously been reported from Fiji, but the present collection suggests it by the habit of the inflorescence, the nature of the pubescence, and the perianth, and is not excluded by the foliage-characters. That the new species does not belong in *Cleidion* is indicated by the shape of the calyx-lobes and the presence of conspicuous foliaceous bracts on the inflorescence. That the cited specimen represents a species new to Fiji seems to be certain.

HIPPOCRATEACEAE

Salacia vitiensis A. C. Sm. in Am. Jour. Bot. **28**: 440. 1941.

VANUA LEVU: Thakaundrove: Between Valanga and Valethi, Savu Savu Bay region, near sea-level, *Degener & Ordonez 14055* (A) (liana, in open forest; flowers and fruit green).

The cited collection is the third of the species known to me; it was obtained fairly near the type-locality. Thus far *S. vitiensis* is known only from Vanua Levu.

Salacia pachycarpa sp. nov.

Frutex scandens sub fructu ubique glaber, ramulis crassis (apicem versus 1.5–3 mm. diametro) teretibus rugosis fusco-cinereis lenticellatis ad nodos incrassatis; foliis oppositis vel suboppositis, petiolis validis canaliculatis 1.5–3 cm. longis, laminis chartaceis siccitate viridi-olivaceis ovato-ellipticis, (6–) 8–18.5 cm. longis, (3–) 4.5–10 cm. latis, basi rotundatis vel obtusis et subito in petiolum decurrentibus, apice obtusis, margine integris et leviter recurvatis, costa supra elevata subtus prominente, nervis secundariis utrinsecus 6–9 curvatis supra paullo subtus valde elevatis, rete venularum intricato utrinque leviter prominulo; inflorescentiis axillaribus ut videtur subfasciculatis, pedicellis fructiferis incrassatis lenticellatis circiter 5 mm. longis, fructibus solitariis subglobosis maturitate 25–30 mm. diametro, basi et apice rotundatis, pericarpio levi lignoso 2–4 mm. crasso, dissepimentis evanescentibus, seminibus ut videtur circiter 4 in pulpo sparso nidulantibus ellipsoideis plerumque angulatis.

VITI LEVU: Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15437* (A, TYPE), June 3, 1941 (liana, in dark forest; native name: *wasam*).

Although the cited collection lacks flowers, there seems to be no doubt that it represents a new species related to *S. vitiensis* A. C. Smith, from which it differs in its stouter habit and much larger leaves, which are distinctly broadest below the middle (rather than oblong-elliptic) and have more obvious secondary nerves and veinlets. The fruits of the two species are very similar. Another relative of *S. pachycarpa* is *S. aneityensis* Guillaumin of the New Hebrides, based upon a collection with only two immature fruits. However, these fruits appear to have a thick pericarp and thus to differentiate the species from *S. prinoides* (Willd.) DC. As compared with *S. pachycarpa, S. aneityensis* has proportionately broader elliptic leaf-blades and the pericarp conspicuously pale-verrucose rather than smooth.

ICACINACEAE

By R. A. HOWARD

Citronella vitiensis Howard, sp. nov.

Arbor parva, ramulis teretibus glabris; foliis 1–1.5 cm. longe petiolatis, laminis subcoriaceis glaberrimis integris late ovatis vel ellipticis, 10–16 cm. longis, 6–12 cm. latis, apice ad 1 cm. longo acuminatis, basi rotundatis vel subcordatis, costa supra vix subtus bene prominente, nervis lateralibus utrinsecus 4 vel 5 arcuatis anastomosantibus; paniculis terminalibus 8–19 cm. longis, cymulis ad 1 cm. longis apice flores plures subcapitato-congestos vel secundo-scorpioides gerentibus, rhachi adpresso-flavido-pubescente; calycis lobis ovatis, 1 mm. longis, 1.5 mm. latis, ciliatis; petalis glabris oblongis, 5 mm. longis, 1.4 mm. latis, costa prominula ornatis; staminibus ad 4.5 mm. longis, filamentis crassiusculis, antheris oblongis 1.2 mm. longis basi cordatis; ovario ovoideo glabro in stylum attenuato; stigmate capitato rugoso; fructibus oblongo-ovoideis ad 3 cm. longis et 1.5 cm. latis complanatis, basi truncatis vel subcordatis, apicem versus angustatis, putamine lignoso conspicue angulari prominenter costato.

VITI LEVU: Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13773* (A) (tree, in forest; flowers pale greenish yellow; native name: *nunga*); Nasinu, *Gillespie 3590* (GH, NY, US). OVALAU: Levuka Reservoir, *Gillespie 4511* (GH, US), *4527* (GH, NY). VANUA LEVU: Thakaundrove: Vatunivuamonde Mt., Savu Savu Bay region, alt. 300 m., *Degener & Ordonez 14007* (A, TYPE) (small tree, in forest).

This species is similar in general appearance to *Citronella samoensis* (A. Gray) Howard, but the fruits are strikingly different. The drupe is strongly prismatic, with sharp angles due to the rugose putamen, and is flattened or concave on one side. The apex is acute and tapers to a point that is centric, not acentric as in

FIG. 3. *Citronella vitiensis* (drawings made from type specimen); *a.* habit, × ½; *b.* pistil, × 10; *c.* diagrammatic cross-section of pistil; *d.* apical view of mature fruit, × ¾; *e.* diagrammatic cross-section of fruit; *f.* seed, × ¾; *g.* embryo, × 4; *h–j.* three views of a single fruit, × ¾. Drawings by R. A. Howard.

C. samoensis. This is the first report of the genus *Citronella* from Fiji, the only other member of the family found there being the common *Medusanthera vitiensis* Seem. For the synonymy of this latter species see Howard in Jour. Arnold Arb. 21: 469. 1940.

SAPINDACEAE

Guioa chrysea sp. nov.

Arbor, innovationibus chryseo-puberulis, ramulis subteretibus demum glabris fusco-cinereis; foliis abrupte pinnatis, petiolo basi incrassato ad 4 cm. longo et rhachi subangulata ut ramulis juvenilibus puberulis vel breviter pilosis; foliolis 5–8 oppositis vel alternatis, petiolulis subcomplanatis 5–8 mm. longis, laminis chartaceis subfalcato-elliptico-oblongis, (6–) 8–13 cm. longis, 2.5–5 cm. latis, basi acutis et in petiolum decurrentibus, apice conspicue acuminatis (acumine ad 1.5 cm. longo obtuso), margine integris et leviter recurvatis, supra glabris vel disperse pilosis, subtus sparse breviter adpresso-chryseo-pilosis ac etiam brunneo-glandulosis, in axillis inter costam ac venas saepe conspicue foveolatis, costa

utrinque prominente, nervis secundariis utrinsecus 5–8 erecto-patentibus irregulariter arcuato-anastomosantibus utrinque valde elevatis, rete venularum intricato utrinque paullo prominulo; inflorescentiis axillaribus vel subterminalibus ad 10 cm. longis copiose ramosis multifloris ubique dense chryseo-pilosis (pilis subpatentibus 0.1–0.2 mm. longis), bracteis anguste oblongis obtusis circiter 2 mm. longis, bracteolis minoribus; floribus in ramulis ultimis brevibus solitariis, pedicellis 0.7–1 mm. longis; sepalis 5 imbricatis submembranaceis concavis suborbicularibus rotundatis 1.5–2.5 mm. diametro glabris vel exterioribus extus ut ramulis inflorescentiae subsericeis; petalis 5 membranaceis suborbicularibus sub anthesi circiter 2.5 mm. diametro (alabastro multo minoribus), glabris vel basim versus ciliolatis, margine undulatis, intus basi squamulatis, squamula bifida 0.4–1 mm. longa distaliter pilis albidis 0.1–0.3 mm. longis dense barbellato-ciliolata; disco annulari integro crenulato glabro; staminibus 8, filamentis filiformibus sub anthesi ad 3 mm. longis albido-pilosis, antheris oblongis 0.6–0.7 mm. longis glabris vel sparse pilosis; ovario rudimentario subconico-triquetro sparse chryseo-sericeo.

Viti Levu: Tholo North: Nandala, vicinity of Nandarivatu, alt. about 750 m., *Degener 14398* (A, type), Feb. 15, 1941 (specimens from fallen tree, in forest).

Guioa chrysea (Sect. *Euguioa*) is a species of the relationship of *G. subfalcata* Radlk., from which it differs in its larger leaflets with more obvious puberulence on the lower surfaces, the short golden hairs of its inflorescence-branches, sepals, etc., and its pilose petal-scales. The leaflets of the new species have less regularly anastomosing secondaries than those of *G. subfalcata* and also have the veinlet reticulation less intricate and not as definitely prominulous.

Koelreuteria formosana Hayata, Ic. Pl. Formos. **3**: 64. *pl. 13.* 1913; Radlk. in Pflanzenr. 98 (IV. **165**): 1333. 1933.

Viti Levu: Tholo North: Below Nandarivatu, alt. about 600 m., *Greenwood 450A* (A) (tree to 11 m. high, in gullies and on hillsides; flowers yellow, the petal-bases red; fruit reddish brown); Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15435* (A) (large tree, in open forest; native name: *lombolombo;* extract of leaves used as a black hair-dye).

Although the collectors' notes do not indicate that this plant is an escape from cultivation, this seems certainly to be the case, as the specimens are not to be distinguished from Formosan material. The genus has not previously been reported from the region. Greenwood comments upon the brevity of the flowering season and states that he has collected the same species from the vicinity of Lautoka.

Harpullia mellea Lauterb. in Bot. Jahrb. **41**: 229. 1908; Radlk. in Pflanzenr. 98 (IV. **165**): 1453. 1934; Christoph. in Bishop Mus. Bull. **128**: 133. 1935.

Kambara: *Smith 1267* (GH, NY) (tree 18 m. high, in forest on limestone formation; fruit red; native name: *vuvula*). Fulanga: *Smith 1153* (GH, NY) (tree 13 m. high, in forest on limestone formation; petals pale yellow; fruit red).

Harpullia mellea has previously been reported from Samoa and Tonga. Although Guillaumin (in Jour. Arnold Arb. **14**: 56. 1933) states that *H. arborea* (Blanco) Radlk. occurs in Samoa and Fiji, I have not been able to find other references to such distribution, nor have I seen specimens of *H. arborea* from these groups. Until specimens are available from Fiji, it seems best to recognize the New Hebrides as the eastern limit of *H. arborea*. I believe that the present reference to *H. mellea* is the first authentic record of the genus in Fiji.

VITACEAE

Cayratia Seemanniana sp. nov.

Vitis saponaria Seem. in Bonplandia **9**: 254, nomen. 1861; Seem. Mission to Viti 434, nomen. 1862; A. Gray in Proc. Am. Acad. **5**: 316, nomen. 1862; A. Gray in Bonplandia

10: 35, nomen. 1862; Seem. Fl. Vit. 44. 1865. Not *Vitis saponaria* Benth. Fl. Austral. **1**: 448. 1863. Not *Cissus saponaria* Planch. in DC. Monogr. Phan. **5**: 574. 1887. Not *Cayratia saponaria* Domin in Rep. Sp. Nov. **11**: 264. 1912; Guillaumin in Jour. Arnold Arb. **12**: 240, as *C. saponacea*. 1931.

Frutex scandens, caulibus gracilibus striatis juventute albo-puberulis et purpurascentibus demum glabris et cinereis; foliis petiolatis trifoliolatis, petiolis gracilibus ut ramulis pallide puberulis ad 12 cm. longis basi incrassatis, petiolulis subteretibus decidue puberulis 1–3.5 cm. (terminalibus ad 6 cm.) longis, laminis tenuiter papyraceis vel subchartaceis ovato-ellipticis, 7–16 cm. longis, 4–12 cm. latis, basi profunde inaequilateraliter cordatis (terminalibus rotundatis), apice obtusis et interdum minute apiculatis, margine conspicue crenatis, supra glabris, subtus in nervis puberulis atque in axillis inter venas ac costam persistenter albido-barbellatis, costa supra elevata subtus prominente, nervis secundariis utrinsecus 5–7 erecto-patentibus (eis basim versus divergentibus et ramosis) utrinque valde prominulis, rete venularum intricato immerso vel utrinque plano; inflorescentiis axillaribus divaricato-cymosis sub anthesi ad 7 cm. sub fructu ad 12 cm. diametro, ubique (pedunculis brevibus, ramulis gracilibus, pedicellis, et calycibus) pilis patentibus albo-cinereo-puberulis atque interdum dense brunneo-glandulosis; floribus in apicibus ramulorum plerumque ternatis, pedicellis gracilibus 1–2 mm. longis; calyce cupuliformi sub anthesi circiter 1.5 mm. longo et 2 mm. diametro, margine truncato vel minute 4-apiculato; petalis 4 membranaceis minute glandulosis oblongis, sub anthesi circiter 3 mm. longis et 2 mm. latis, apice subacutis; staminibus 4 in sulculis minutis disci insertis, filamentis glabris filiformibus 1.4–1.7 mm. longis, antheris oblongo-ellipsoideis circiter 0.7 mm. longis; disco carnoso leviter crenulato minute pallido-glanduloso; ovario in disco immerso, stylo conico circiter 1 mm. longo obtuso, ovulis 4; baccis depresso-globosis rugulosis 7–8 mm. diametro minute luteo-glandulosis columna stylorum persistenter coronatis, pericarpio carnoso, seminibus 3 vel 4 ellipsoideis circiter 5 mm. longis et latis intus conspicue angulatis et fossa plus minusve profunda praeditis.

Viti Levu: Ra: Saulangitua, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15502* (A, type), June 10, 1941 (liana, in forest). Ovalau: Vicinity of Levuka, alt. 400 m., *Gillespie 4485* (GH). Moturiki: *Seemann 76* (GH) (native name: *wa roturotu*). Vanua Levu: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH).

There has been considerable confusion concerning the name *Vitis saponaria* and various combinations based upon it. Although the name appeared several times previous to the publication of the first part of Flora Vitiensis in 1865, it was validly published only by Bentham (Fl. Austr. **1**: 448. 1863). The type of the species, therefore, is the plant upon which Bentham based his description. The only specimens actually cited by Bentham are Australian collections of R. Brown and MacGillivray, and these are to be considered cotypes. The fact that Bentham accredits the name to Seemann, on the supposition that the plant listed by Seemann in his Mission to Viti (and also in his reprinted Syst. List Vit. Pl. 4. 1862) is conspecific with the Australian plant, does not give the Fijian collection of Seemann the status of type.

Later authors, including Planchon and Domin, have accepted the Australian and Fijian plants as conspecific and have erroneously accredited the name to Seemann. The correct modern combination for the Australian plant would appear to be *Cayratia saponaria* (Benth.) Domin; even though Domin does not cite Bentham's publication, it is obvious that he is basing his new combination upon Bentham's concept, since only the MacGillivray specimen is cited.

Since it now appears that the Fijian and Australian plants are not conspecific, and since the name *Vitis saponaria* must definitely be taken for the latter, the former should receive a new name. The Fijian specimens cited by Seemann and

Gray have no status as types and therefore it is not necessary to base the new name upon them. I prefer to designate the recent Degener collection as the type, since the material is more complete and ample than that of previous collections. As to the identity of the New Hebrides plant which Guillaumin (in Jour. Arnold Arb. **12**: 240. 1931) cites as *Cayratia "saponacea,"* this is clearly not conspecific with the Fijian plants cited above.

Cayratia Seemanniana differs from the Australian *C. saponaria* (Benth.) Domin in having its leaflets thinner and with persistent tufts of hairs in the axils of nerves on the lower surface, its lateral leaflets more conspicuously cordate, and the leaflet-margins more deeply crenulate; whether or not there are good floral differences I cannot say at present. The new species is also closely related to the Papuasian *C. grandifolia* (Warb.) Merr. & Perry, a species with larger and somewhat thicker leaflets with more sharply prominulous veinlets on the lower surfaces and without the definite axillary tomentum, and with a more ample inflorescence.

Cayratia acuminata (A. Gray) comb. nov.

Cissus acuminata A. Gray, Bot. U. S. Expl. Exped. **1**: 273. 1854; Planch. in DC. Monogr. Phan. **5**: 564. 1887.

Vitis acuminata Seem. in Bonplandia **9**: 255. 1861; Fl. Vit. 44. 1865.

Viti Levu: Tholo North: Nandarivatu, alt. 850 m., *Degener & Ordonez 13575* (A) (liana, in rain-forest).

The cited specimen, in the texture, shape, and cutting of its leaflets, very closely resembles the rather unsatisfactory type collection (*U. S. Expl. Exped.*, GH, from Ovalau). The lateral leaflets of the older collection are sometimes divided and the leaf is thus 5-foliolate; the present collection, which is sterile, has leaves always 3-foliolate. The species represents neither *Cissus* nor *Vitis*, according to the treatment proposed by Gagnepain (in Bull. Soc. Hist. Nat. Autun **24**: 1–41. 1911). Its probable place in *Cayratia* is suggested by its superficial resemblance to such species as *C. japonica* (Thunb.) Gagnep. and *C. trifolia* (L.) Domin.

BIXACEAE

Bixa Orellana L. Sp. Pl. 512. 1753; Setch. in Carn. Inst. Publ. **341**: 68. 1924; Guillaumin in Jour. Arnold Arb. **12**: 225. 1931; Christoph. in Bishop Mus. Bull. **128**: 149. 1935.

Viti Levu: Tholo North: Nandrau, alt. about 600 m., *Degener 14898* (A) (naturalized, escape from cultivation; native name: *ngesa;* dye from seeds used as facial decoration). Without locality: *Horne* (GH).

This common species, cultivated in essentially all warm countries, is apparently to be included in the naturalized flora of Fiji. The family has not previously been reported from the group in taxonomic literature.

VIOLACEAE

Agatea violaris A. Gray, f. **typica** f. nov.

Agatea violaris A. Gray, Bot. U. S. Expl. Exped. **1**: 89. *pl. 7.* 1854; Seem. Fl. Vit. 6. 1865.

Planta foliis glabris, ramulis inflorescentiae sub anthesi arcte puberulis.

Gray originally described two varieties of this species without naming them. Var. α was said to have oblong-lanceolate leaves subequal to the panicles, and var. β larger ovate-oblong leaves exceeding the panicles. Numerous modern collections of the species indicate that there are all variations between these extremes.

While I do not believe, therefore, that there is any necessity for the two varieties as proposed by Gray, and while I intend to include both of these varieties in my forma *typica,* I nevertheless here designate the type of his var. β as the type of my forma *typica,* in order to avoid any future confusion. In the present collection, the following specimens are referable to *A. violaris* f. *typica:*

Viti Levu: Tholo North: *Degener & Ordonez 13576, Degener 14367, 14403, 14679;* Ra: *Degener 15507;* Rewa: *Degener & Ordonez 13771.* Vanua Levu: Thakaundrove: *Degener & Ordonez 14182, 14200* (all A).

Of the cited specimens, no. *14182* is fairly close to the type of Gray's var. α, the others more nearly resembling his var. β. I propose the forma *typica* to include both of Gray's unnamed varieties and all the other material of the species which I have seen, with the exception of two collections referable to the following.

Agatea violaris A. Gray, f. **mollis** f. nov.

Planta laminis foliorum subtus et interdum supra dense et molliter cinereo-pilosis, ramulis inflorescentiae sub anthesi conspicue pilosis.

Viti Levu: Tholo West: Mbulu, near Sovi Bay, alt. 30–60 m., *Degener 15046* (A) (liana, in forest); Naruku, vicinity of Mbelo, near Vatukarasa, alt. about 250 m., *Degener 15314* (A, type), May 18, 1941 (liana, in forest; native name: *wa ndrengandrenga*).

Although no floral or other consequential differences are discernible between the cited specimens and specimens of the typical form, the conspicuous pubescence makes nomenclatural recognition of this form desirable. The fact that *Degener 14403,* cited as the form *typica,* has a few soft hairs on the lower leaf-surface indicates that the differences between the two forms are not of great consequence.

FLACOURTIACEAE

The Fijian specimens of *Homalium* have been referred in herbaria to two species, *H. vitiense* Benth. and *H. nitens* Turrill. Among the collections now available to me, it seems obvious that more than two species are distinguishable, although their characters are somewhat intangible and difficult to express without resorting to measurements. All appear to be endemic and all have the stamens in threes (occasionally in fours), being members of the Section *Eumyriantheia,* according to Gilg's treatment (in E. & P. Nat. Pfl. ed. 2. **21**: 426. 1925). Fairly dependable specific characters are apparently to be found in the flower-size, the proportions of perianth-segments to stamens and styles, the length of the inflorescence and pedicels, and to a certain extent in foliage. The five species recognized in the following key seem quite satisfactory on the basis of present material.

Flowers 2.5–4 mm. long at anthesis, the calyx-tube nearly as broad as long; perianth-segments 1.4–2.2, 1.2–2.5 mm. long; glands at base of perianth glabrous; stamens and styles at anthesis subequal to or exceeding the perianth-segments.

Inflorescence 6–12 cm. long, the bracts 0.7–1.6 mm. long, the flowers 2.5–3 mm. long, subsessile or on pedicels to 1.5 mm. long ..... 1. *H. vitiense.*

Inflorescence 12–20 cm. long, the bracts 1.5–2 mm. long, the flowers 3.5–4 mm. long, on pedicels 2–3 mm. long ..... 2. *H. Gillespiei.*

Flowers 4.5–7 mm. long at anthesis, the calyx-tube comparatively narrow, longer than broad; perianth-segments 3–4.5 mm. long, longer than the calyx-tube.

Stamens and styles less than one-half as long as the perianth-segments; glands at base of perianth densely hirsute; leaf-blades cuspidate at apex.

Inflorescence 8–16 cm. long, the pedicels 1–3 mm. long, the flowers 5–7 mm. long; perianth-segments 1.6–2.2; leaf-blades 5–8 cm. long, 2.5–5 cm. broad .... 3. *H. nitens.*

Inflorescence 16–24 cm. long, the pedicels 0.7–1.5 mm. long, the flowers 4.5–6 mm. long; perianth-segments 1.2–1.6; leaf-blades 8–15 cm. long, 5–9 cm. broad .. 4. *H. laurifolium.*

Stamens and styles 3–4 mm. long, nearly as long as the 16–18 perianth-segments; glands at base of perianth subglabrous; pubescence of inflorescence dense and conspicuous; leaf-blades rounded or obtuse at apex ..... 5. *H. pallidum.*

1. **Homalium vitiense** Benth. in Jour. Linn. Soc. Bot. **4:** 36. 1860; Seem. Fl. Vit. 95. 1865.

VITI LEVU: Tholo North: Fatia, west of Tavua, alt. 30–60 m., *Degener 14969* (A) (tree 4 m. high, in dry forested ravine; flowers greenish); Naitasiri: Tamavua woods, 6 miles from Suva, alt. 150 m., *Gillespie 2018* (GH, NY). VANUA LEVU: Thakaundrove: Natewa Peninsula, hills west of Mbutha Bay, alt. 150–350 m., *Smith 831* (GH, NY) (tree 5 m. high, on exposed cliff-head; flowers white). WITHOUT LOCALITY: *Horne 490* (GH).

Although I have not seen the type of this species, collected by Milne on Viti Levu, there seems little doubt, from the description, that the small-flowered specimens cited above represent the same species.

2. **Homalium Gillespiei** sp. nov.

Arbor (?), ramulis gracilibus subteretibus fusco-cinereis juventute cinereo-puberulis mox glabris et conspicue lenticellatis; petiolis gracilibus canaliculatis 6–9 mm. longis ut ramulis decidue puberulis; laminis chartaceis siccitate fuscis ovato-ellipticis, 5–8 cm. longis, 3–4 cm. latis, basi obtusis et in petiolum decurrentibus, apice obtuse cuspidatis, margine crenato-serratis (dentibus obtusis 2–4 per centimetrum), utrinque praeter costam interdum inconspicue puberulam glabris, costa utrinque paullo elevata, nervis secundariis utrinsecus 5–8 arcuato-adscendentibus utrinque valde prominulis, rete venularum intricato utrinque prominulo; inflorescentiis racemosis axillaribus solitariis 12–20 cm. longis, pedunculo ad 3 cm. longo et rhachi gracilibus dense hirsutis (pilis albo-cinereis 0.3–0.7 mm. longis), bracteis pilosis oblongis 1.5–2 mm. longis, pedicellis sub anthesi strigosis 2–3 mm. longis; floribus sub anthesi 3.5–4 mm. longis cinereo-strigosis, tubo calycis turbinato 1–1.5 mm. longo et lato; sepalis 7 vel 8 submembranaceis lanceolatis, 2–2.5 mm. longis, circiter 0.3 mm. latis, utrinque strigosis; petalis 7 vel 8 sepalis similibus; glandulis glabris subglobosis circiter 0.2 mm. diametro; staminibus 3 (raro 4) in fasciculis, filamentis filiformibus patente-hirsutis petala subaequalibus, antheris minutis subglobosis circiter 0.15 mm. diametro; ovario piloso, stylis plerumque 5 basi connatis distaliter liberis filiformibus stamina subaequalibus.

VITI LEVU: Tholo North: Nasukamai, near Wainimbuka River, alt. 400 m., *Gillespie 3394.6* (GH, TYPE, NY), Dec. 27, 1927.

The cited specimen has characters suggestive of both *H. vitiense* and *H. nitens,* but I believe that it cannot be referred to either. Its small flowers, with stamens and styles subequalling the perianth, resemble those of *H. vitiense,* while its long bracts and pedicels suggest those of *H. nitens.* The inflorescence of the new species is conspicuously elongate.

3. **Homalium nitens** Turrill in Jour. Linn. Soc. Bot. **43:** 23. 1915.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, *im Thurn 132* (NY, TYPE COLL.); alt. about 830 m., *Reay 18* (A) (shrub to 3 m. high; inflorescence brown to pink; native name: *molaca;* infusion of bark used as a tonic); Serua: Vicinity of Ngaloa, alt. about 30 m., *Degener 15087* (A), *15088* (A) (trees, in forest; inflorescence grayish or pink; native name: *tarotaro;* fresh inflorescences woven into necklaces).

The young inflorescences appear to be pink, subsequently fading to a gray or brown color.

4. **Homalium laurifolium** sp. nov.

Arbor ad 3 m. alta, ramulis subteretibus gracilibus glabris cinereis pallide lenticellatis; petiolis canaliculatis nigrescentibus (5–) 10–18 mm. longis; laminis chartaceis ovato-ellipticis, 8–15 cm. longis, 5–9 cm. latis, basi rotundatis vel ob-

tusis et in petiolum subito decurrentibus, apice obtuse cuspidatis vel breviter acuminatis, margine leviter recurvatis et undulato-crenatis, utrinque glabris, costa supra elevata subtus prominente, nervis secundariis utrinsecus 5–7 arcuato-adscendentibus utrinque acute elevatis, rete venularum intricato utrinque valde prominulo; inflorescentiis axillaribus racemosis 16–24 cm. longis, pedunculo ad 6 cm. longo et rhachi gracilibus densissime et breviter cinereo-hirsutis, bracteis linearibus acutis hirsutis 1.5–2 mm. longis, pedicellis sub anthesi pilosis 0.7–1.5 mm. longis; floribus sub anthesi 4.5–6 mm. longis, tubo calycis obconico, 1.5–2.5 mm. longo, 1–1.2 mm. lato, dense pilosulo; sepalis 6–8 membranaceis ligulatis, 3–3.5 mm. longis, 0.3–0.4 mm. latis, subacutis, utrinque pilis 0.4–0.7 mm. longis dense cinereo-hirsutis; petalis 6–8 sepalis similibus; glandulis dense hirsutis subglobosis circiter 0.3 mm. diametro; staminibus 3 in fasciculis quam petalis multo brevioribus, filamentis filiformibus 0.7–1 mm. longis basim versus sparse hirsutis, antheris circiter 0.25 mm. latis; ovario dense hirsuto, stylis 5 basi connatis superne liberis et filiformibus stamina subaequalibus.

Viti Levu: Tholo West: Naruku, vicinity of Mbelo, near Vatukarasa, alt. about 250 m., *Degener 15307* (A, type), May 18, 1941 (tree 3 m. high, in forest; native name: *sakisakivuto;* inflorescences used for necklaces; cold-water extract from wood used medicinally); Rewa: Suva, *Meebold 8175* (NY).

The new species is readily distinguished from *H. nitens,* its closest relative, by the characters indicated in the key and also by the fact that the stamens and styles are proportionately shorter, being only about one-third or less the length of the petals. The Meebold specimen differs from the type in its somewhat shorter petioles, but in all other characters the cited specimens agree closely.

5. **Homalium pallidum** sp. nov.

Arbor 15 m. alta, ramulis subteretibus crassis juventute pallidis et obscure puberulis demum fusco-cinereis glabris conspicue albido-lenticellatis; petiolis pallidis crassis canaliculatis 6–10 mm. longis mox glabris; laminis chartaceis siccitate olivaceis late ellipticis vel subrotundatis, 5–9 cm. longis, 4–6.5 cm. latis, basi rotundatis et in petiolum subito decurrentibus, apice rotundatis vel obtusis, margine conspicue undulato-crenatis et leviter recurvatis, utrinque glabris, costa supra elevata subtus prominente, nervis secundariis utrinsecus 5–7 arcuato-adscendentibus utrinque valde prominulis, rete venularum intricato utrinque prominulo; inflorescentiis axillaribus et racemosis vel terminalibus et paniculatis, racemis (vel ramulis paucis paniculae brevis) 6–9 cm. longis, pedunculo brevi et rhachi gracilibus densissime cinereo-pilosis, bracteis ovato-oblongis circiter 1.5 mm. longis extus strigosis, pedicellis sub anthesi pilosis 1–2 mm. longis; floribus sub anthesi 6.5–7 mm. longis, tubo calycis obconico, 2–2.5 mm. longo, 1.5–2 mm. lato, minute et dense cinereo-subsericeo; sepalis 8 vel 9 membranaceis obovato-lanceolatis, 3.5–4.5 mm. longis, 0.6–0.8 mm. latis, apice acutis, utrinque sericeis; petalis 8 vel 9 sepalis similibus; glandulis subglabris subglobosis circiter 0.3 mm. diametro; staminibus 3 in fasciculis, filamentis filiformibus basim versus sparse pilosis petala subaequalibus (3–4 mm. longis), antheris oblongis circiter 0.3 mm. longis; ovario hirsuto, stylis 5 basi connatis superne liberis et filiformibus stamina subaequalibus.

Fulanga: *Smith 1221* (GH, NY, type), Feb. 26, 1934 (tree 15 m. high, in forest on limestone formation; petals white; native name: *mbolovatu;* wood hard and considered useful).

The long stamens and styles of the large flowers, the densely pubescent inflorescences, and the broad subrotund leaves amply differentiate this species from its allies. It bears a close floral resemblance to *H. aneityense* Guillaumin, of the New Hebrides, but that species has the stamens in fives (in several flowers which I dissected), while its leaf-blades lack the conspicuous crenations of the new species.

Xylosma Archboldianum sp. nov.

Arbor praeter inflorescentiam glabra, ramulis gracilibus subteretibus fusco-cinereis conspicue lenticellatis; petiolis leviter canaliculatis 3–6 mm. longis; laminis chartaceis siccitate viridi-olivaceis supra nitidis ovatis, 4–7 cm. longis, 2–3.5 cm. latis, basi rotundatis et in petiolum subito decurrentibus, apice obtusis vel leviter emarginatis, margine integris et leviter recurvatis, costa supra subplana vel paullo elevata subtus valde elevata, nervis secundariis utrinsecus 4–7 adscendentibus utrinque valde prominulis, rete venularum intricato acute prominulo; inflorescentiis ♂ immaturis solis visis axillaribus congestis breviter racemosis vel subfasciculatis plurifloris, rhachi pedicellisque cinereo-puberulis, bracteis obovato-oblongis obtusis circiter 0.7 mm. longis, pedicellis brevibus ante anthesim 1 mm. longis; sepalis 4 late ovato-deltoideis ante anthesim circiter 0.7 mm. longis et 1 mm. latis subacutis ciliolatis; staminibus circiter 30, filamentis brevibus, antheris oblongis circiter 0.4 mm. longis.

Viti Levu: Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15435a* (A, type), June 3, 1941 (tree, on dry forested forehill).

Following Sleumer's revision of the Malaysian-Pacific species of *Xylosma* (in Notizbl. Bot. Gart. Berlin **14**: 288–297. 1938), *X. Archboldianum* is closely related only to *X. Guillauminii* Sleumer of the New Hebrides, differing in its more distinctly ovate leaf-blades, which are rounded rather than subacute at base, more conspicuously shining, and with more sharply prominulous veinlet-reticulation. The known flowers of both species are very immature, but it seems likely that the inflorescence of *X. Archboldianum* will prove to be more compact. The new species is not closely related to *X. orbiculatum* (Forst.) Forst. f., the only species previously known from Fiji.

Flacourtia ovata Gillespie in Bishop Mus. Bull. **83**: 27. *f. 34* (excl. *a, f, g*). 1931.

Viti Levu: Naitasiri: Tamavua woods, 6–7.5 miles from Suva, alt. 150 m., *Gillespie 2175* (GH), *2446* (type coll., GH, NY); Serua: Vatuvilakia, vicinity of Ngaloa, alt. 90 m., *Degener 15152* (A) (few-branched virgate tree or shrub to 3 m. high, in dense forest); Vatutavathe, near Ngaloa, alt. 150 m., *Degener 15202a* (A) (in forest).

In describing this species, Gillespie also cites his no. *3963* and *Horne 301*. These specimens differ from the type collection in their smaller and thinner leaves, and also in a stylar character which will be pointed out below, as I believe them to represent an undescribed species. No staminate flowers of *F. ovata* are known, those described by Gillespie having been taken from *Horne 301*. This part of his description, therefore, and also figs. *a, f,* and *g* of his plate should be taken to refer to the following new species.

Flacourtia subintegra sp. nov.

Arbor gracilis ad 8 m. alta inflorescentiis minute puberulis exceptis glabra, ramulis subteretibus gracilibus fusco-cinereis conspicue lenticellatis; petiolis leviter canaliculatis 5–8 mm. longis; laminis chartaceis vel papyraceis siccitate fusco-olivaceis ovato-ellipticis, 6–10 cm. longis, 3–6 cm. latis, basi rotundatis vel late obtusis, apice obtusis vel obtuse cuspidatis, margine integris vel inconspicue undulato-crenulatis, costa supra paullo elevata subtus prominente, nervis secundariis utrinsecus 4–6 adscendentibus marginem versus arcuatis et inconspicue anastomosantibus utrinque acute elevatis, rete venularum intricato utrinque prominulo; inflorescentiis ♂ axillaribus compactis breviter racemosis vel subfasciculatis 3–12-floris, pedunculo brevi, rhachi, et pedicellis minute cinereo-puberulis vel subglabris, bracteis ovatis obtusis 0.5–1 mm. longis, ramulis lateralibus (infra articulationem pedicelli) 1–1.5 mm. longis, pedicellis gracilibus sub anthesi 2–3 mm. longis (supra articulationem); sepalis 4 submembranaceis deltoideo-ovatis, 1–1.5 mm. longis, 1.5–1.7 latis, apice rotundatis, sparse puberulis glabrescentibus;

disco glanduloso conspicue crenulato; staminibus numerosis (circiter 40–50), filamentis filiformibus sub anthesi 1.5–2 mm. longis, antheris oblongis circiter 0.5 mm. diametro; fructibus obovato-ellipsoideis maturitate ad 7 mm. diametro apice stylis 5 vel 6 minutis et distinctis coronatis, pericarpio subcarnoso, pyrenis plerumque 8–10 ellipsoideis 3–4 mm. longis.

VITI LEVU: Tholo North: Korovou, east of Tavua, alt. 60–120 m., *Degener 14953* (A) (tree 2 m. high, in isolated dry forested ravine); vicinity of Nandarivatu, alt. 900 m., *Gillespie 3963* (GH). VANUA LEVU: Mbua: Southern portion of Seatovo Range, alt. 100–350 m., *Smith 1700* (GH, NY) (slender tree 4 m. high, in thickets along stream; fruit deep red); Thakaundrove: Natewa Bay region, hills west of Korotasere, alt. 100–300 m., *Smith 1939* (GH, NY, TYPE), June 8, 1934 (tree 8 m. high, in dense forest; anthers pale yellow). WITHOUT DEFINITE LOCALITY: *Horne s. n.* (GH), *301* (GH).

Flacourtia subintegra differs from *F. ovata* Gillespie in its conspicuously smaller and thinner leaf-blades, those of *F. ovata* being (9–) 12–28 cm. long and (5.5–) 7–15 cm. broad. The fruits of the new species are smaller, and even when fully mature do not exceed 7 mm. in diameter; they are surmounted by 5 or 6 minute and quite separate styles, whereas the styles of *F. ovata* are conspicuous and ascending from an obviously common base. Of the cited specimens, the type and *Horne 301* bear staminate flowers, the others being in fruit.

Flacourtia Degeneri sp. nov.

Arbor inflorescentiis exceptis glabra, ramulis crassis teretibus fusco-cinereis lenticellatis; petiolis crassis canaliculatis 5–9 mm. longis; laminis chartaceis siccitate fusco-olivaceis ovatis, 9–15 cm. longis, 5–8 cm. latis, basi rotundatis et in petiolum subito decurrentibus, apice obtusis vel obtuse et gradatim angustatis, margine conspicue crenulatis (dentibus 2 vel 3 per centimetrum), costa supra paullo elevata subtus prominente, nervis secundariis utrinsecus 7–9 adscendentibus marginem versus arcuatis et anastomosantibus utrinque acute elevatis, rete venularum intricato supra paullo subtus valde prominulo; inflorescentiis ♂ axillaribus breviter racemosis vel subfasciculatis plurifloris, rhachi pedicellisque dense puberulis, bracteis oblongis obtusis 1–2 mm. longis, ramulis lateralibus (infra articulationem pedicelli) 3–4.5 mm. longis, pedicellis gracilibus sub anthesi 5–7 mm. longis (supra articulationem); sepalis 4 submembranaceis ovatis, circiter 2.5 mm. longis et latis, apice obtusis, extus glabris, intus puberulis; disco glanduloso conspicue crenulato; staminibus numerosis (circiter 80), filamentis filiformibus sub anthesi 2–3 mm. longis, antheris oblongis 0.7–0.9 mm. longis.

VITI LEVU: Tholo North: Nandrau, vicinity of Nandarivatu, alt. about 600 m., *Degener 14890* (A, TYPE), Mar. 26, 1941 (in forest).

Flacourtia Degeneri differs from the preceding new species (*F. subintegra*) in its conspicuously crenulate rather than subentire leaf-blades, which on the average are slightly larger. Staminate flowers of *F. Degeneri* are larger in all dimensions, this being especially obvious when the pedicels are examined. As compared with *F. ovata* Gillespie, the new species has the leaf-blades thinner in texture, averaging smaller, more conspicuously and more finely crenulate, and with more intricate and obvious veinlet-reticulation. When flowers and fruits of both species are known, other characters of separation may be apparent.

Casearia disticha A. Gray, Bot. U. S. Expl. Exped. **1**: 81 (excl. syn.). *pl. 5A*. 1854; Seem. Fl. Vit. 98. 1865; Briquet in Ann. Conserv. Jard. Bot. Genève **2**: 64. 1898.

Casearia Seemanni Briquet in Ann. Conserv. Jard. Bot. Genève **2**: 65, sphalm. 1898.

In the cited publication, Briquet proposes a variety *minor* of *C. Melistaurum* Spreng., basing it upon several New Caledonian collections and also citing: "Iles Fiji (ex A. Gray l. c.)." Gray, however, had referred no Fijian plant to *C. Melistaurum*, merely indicating the possibility that his *C. disticha* would prove to be

conspecific with the New Caledonian plant. That Briquet did not wish to reduce *C. disticha* to *C. Melistaurum* var. *minor* is indicated by his subsequent redescription of *C. disticha*. It may be safely assumed, upon the basis of collections up to the present, that *C. Melistaurum* does not occur in Fiji; it differs from *C. disticha* in obvious foliage characters. Although Gray, in his choice of a specific name, indicated his belief that the Fijian plant might be conspecific with *Melistaurum distichum* Forst., his binomial is definitely to be taken as a new species and not a new combination.

Casearia disticha is fairly common in Fiji and appears to be quite variable. As I interpret the species, it includes the following collections:

VITI LEVU: Tholo North: Nandarivatu, alt. 850 m., *Degener & Ordonez 13588* (A), *13608* (A); Loma Langa Mt., alt. 1200 m., *Gillespie 3342* (GH). KANDAVU: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith, 93, 100, 165* (all GH, NY). OVALAU: *Seemann 11* (GH); vicinity of Levuka, alt. 500 m., *Gillespie 4427* (GH). VANUA LEVU: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, TYPE COLL.); Thakaundrove: Savu Savu Bay region, alt. about 90 m., *Degener & Ordonez 13849, 13850, 14184* (all A); Mt. Ndikeva, alt. 500–700 m., *Smith 1889, 1906* (both GH, NY). WITHOUT DEFINITE LOCALITY: *Storck 9* (GH); *Horne s. n.* (GH).

The type collection has thin leaf-blades, with prominulous veinlets on the lower surface, and comparatively short petioles (2–5 mm. long). Essentially identical with this are: *Seemann 11, Horne s. n., Storck 9,* and *Gillespie 3342* and *4427*. A form with leaf-blades similar in texture but with petioles 5–13 mm. long is represented by *Degener & Ordonez 13588* and *13608* and *Smith 1889* and *1906*. Similar to this, but with the leaf-blades a trifle thicker in texture, are *Smith 93, 100,* and *165*. A form close to the type, but with the leaf-blades inclined to be distinctly ovate, rather than elliptic, is represented by *Degener & Ordonez 13849, 13850,* and *14184*. The first of these latter specimens has the leaf-blades unusually large, up to 20 cm. long and 9 cm. broad.

The flowers of the cited specimens are all essentially similar, even in the most minute details. In view of this, it seems that the various foliage forms are not worthy of nomenclatural recognition. Closely allied to this complex is the specimen described by Gray as *C. Richii* A. Gray (Bot. U. S. Expl. Exped. 1: 82. *pl. 5B.* 1854; Seem. Fl. Vit. 98. 1865). This may be merely a form of *C. disticha* with more compact habit and smaller leaves, but for the time being it is perhaps best retained as a species. It is represented by *Degener 15073* (A), from Mt. Ngamo, near Ngaloa, Serua, Viti Levu.

Casearia angustifolia sp. nov.

Frutex ad 4 m. altus, ramulis gracilibus subteretibus glabris fusco-cinereis; petiolis canaliculatis 2–3 mm. longis; laminis chartaceis siccitate viridi-olivaceis anguste oblongis, 6–10 cm. longis, 2–3 cm. latis, basi rotundatis vel late obtusis, apice gradatim acuminatis, margine dentibus callosis circiter 3 per centimetrum minute serrulatis, pellucido-punctatis vel breviter lineolatis, supra glabris subtus costa et praecipue in axillis nervorum breviter hirsutis et barbellatis demum glabris, costa supra prominula vel subplana subtus elevata, nervis secundariis utrinsecus 5 vel 6 adscendentibus curvatis supra subplanis subtus leviter elevatis, rete venularum intricato supra obscuro subtus leviter prominulo; inflorescentiis axillaribus fasciculatis plurifloris, bracteis numerosis puberulis subacutis deltoideo-oblongis 1–1.5 mm. longis, pedicellis gracilibus subglabris sub anthesi circiter 1 mm. longis obscure articulatis; sepalis 5 membranaceis imbricatis concavis ellipticis 1.5–2 mm. longis, conspicue glandulosis (glandulis opacis), evidenter nervatis, apice rotundatis, exterioribus apicem versus puberulis; staminibus 10 alternatim inaequalibus, filamentis filiformibus minute puberulis alternatim circiter 0.6

mm. et 1 mm. longis, antheris late oblongis circiter 0.3 mm. longis; lobis disci anguste oblongis circiter 0.5 mm. longis, apice debiliter pilosis; ovario glabro ellipsoideo sub anthesi circiter 1 mm. longo, stylo brevi crasso, stigmate capitato circiter 0.4 mm. diametro.

VANUA LEVU: Thakaundrove: Southern slope of Mt. Mariko, alt. 400–600 m., *Smith 411* (GH, TYPE, NY), Nov. 14, 1933 (shrub 4 m. high; flower-buds green).

Casearia angustifolia, a member of the Section *Pitumba* and closely related to *C. disticha* A. Gray, differs from that species in having its leaf-margins minutely but distinctly serrulate with callose-tipped teeth rather than entire or very inconspicuously crenulate-serrulate. *Casearia disticha* has its sepals often thick and usually opaque, with the veins immersed and the glands either not obvious or pellucid; *C. angustifolia,* on the other hand, has its sepals membranous and translucent, with obvious veins, and conspicuously punctate with opaque glands. The leaf-blades of the new species are proportionately narrower than those of *C. disticha* and have more ascending secondaries.

Casearia longifolia sp. nov.

Arbor circiter 3 m. alta inflorescentiis et stipulis exceptis ubique glabra, ramulis elongatis gracilibus teretibus fusco-cinereis leviter flexuosis lenticellatis, stipulis anguste deltoideis circiter 1.5 mm. longis extus pilosis; petiolis gracilibus canaliculatis 5–9 mm. longis; laminis chartaceis siccitate viridibus oblongo-lanceolatis, 10–14 cm. longis, 2–3.5 cm. latis, basi anguste acutis et in petiolum gradatim decurrentibus, apicem versus angustatis et apice ipso obtusis, margine integris vel leviter undulato-crenulatis, copiose pellucido-punctatis, costa supra leviter elevata subtus prominente, nervis secundariis utrinsecus 9–13 arcuato-adscendentibus utrinque valde prominulis, rete venularum utrinque leviter prominulo; inflorescentiis axillaribus, floribus 1—pluribus forsan in specimine nostro abnormibus, bracteis numerosis papyraceis obtusis oblongo-ellipticis circiter 1 mm. longis extus puberulis, pedicellis sub fructu juvenili glabris crassis 2–3 mm. longis; sepalis 5 sub fructu subcoriaceis rotundatis glabris late ovatis, 1.5–2 mm. longis, circiter 3 mm. latis; filamentis persistentibus (et staminodiis ac lobis disci?) numerosis congestis lanceolatis ad 3 mm. longis puberulis basi incrassatis; fructibus juvenilibus ellipsoideis, in specimine nostro 3–4 mm. longis et latis, dense tomentellis, stylo brevi crasso, stigmate subcapitato.

VITI LEVU: Ra: Vatundamu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15390* (A, TYPE), June 2, 1941 (tree 3 m. high, on dry forested forehill).

It seems likely that the flowers of the cited specimen are not normal, as the appendages around the ovary are more numerous than is to be expected in *Casearia,* if these are to be construed as old filaments and lobes of the disk. In addition, the young fruits appear to be sterile and unusually thick-walled. However, there is no doubt that the specimen represents a *Casearia,* and its relationship is probably with *C. disticha* A. Gray and its allies; it is readily distinguished by its long and narrow leaf-blades, numerous secondary nerves, etc. Normal young flowers are desired for the satisfactory placing of the species.

TURNERACEAE

Turnera ulmifolia L. Sp. Pl. 271. 1753.

VANUA LEVU: Thakaundrove: Waina, Maravu, near Salt Lake, near sea-level, *Degener & Ordonez 14193* (A) (very common naturalized weed under coconut palms; shrub about 1 m. high; flowers yellow).

This common American weed may be a recent introduction, as it apparently has not previously been reported from Fiji. The collectors report it to be very localized. The family is new to the literature dealing with Fijian plants.

PASSIFLORACEAE

(determinations by E. P. Killip)

Passiflora suberosa L. Sp. Pl. 958. 1753; Killip in Field Mus. Publ. Bot. **19**: 88. 1938.

OVALAU: Near Levuka, alt. 15 m., *Degener & Ordonez 13788* (A) (vine, in pasture).

This tropical American species, which has been widely introduced into the Old World tropics, has been reported from Hawaii, New Caledonia, and the Loyalty Islands, but apparently not from other parts of the Pacific.

Passiflora maliformis L. Sp. Pl. 956. 1753; Killip in Field Mus. Publ. Bot. **19**: 352. 1938.

VITI LEVU: Ra: Nanukuloa, *Degener & Ordonez 13673* (A) (vine; an escape).

Previously reported, in the Pacific, only from Rarotonga, this tropical American species is probably becoming naturalized in Fiji.

Passiflora foetida L. var. **hispida** (DC.) Killip in Bull. Torrey Bot. Club **58**: 408. 1931; in Field Mus. Publ. Bot. **19**: 494. 1938.

VITI LEVU: Lautoka: Lautoka, near sea-level, *Degener & Ordonez 13686* (A, US) (roadside weed; fruit yellow).

This widespread variety has not previously been reported from Fiji, nor has the species. However, *P. foetida* is known as a weed in several other Pacific groups, including Samoa and the New Hebrides; probably some reports of the species in the Pacific are referable to the variety *hispida*.

THYMELIACEAE

Gonystylus punctatus sp. nov.

Arbor ad 5 m. alta, ramulis subteretibus gracilibus rugulosis brunneo-purpurascentibus apicem versus interdum sparse pilosis mox glabris; foliis alternatis, petiolis crassis rugulosis subteretibus 10–17 mm. longis juventute sparse strigoso-puberulis mox glabris, laminis chartaceis vel subcoriaceis glabris siccitate viridi-olivaceis oblongis, 9–15 cm. longis, 3–7 cm. latis, basi rotundatis vel late obtusis, apice gradatim angustatis et obtusis vel subacutis, margine integris et leviter recurvatis, copiose et conspicue pellucido-punctatis, costa supra paullo canaliculata vel interdum prominula subtus prominente, nervis secundariis utrinsecus 15–20 patentibus cum aliis similibus numerosis interspersis marginem versus anastomosantibus utrinque acute prominulis, rete venularum intricato utrinque plus minusve prominulo; inflorescentiis apice ramulorum brevium terminalibus solitariis ad 9 cm. longis ut videtur pauciramosis et anguste paniculatis, pedunculo brevi, rhachi ramulisque pilis luteo-cinereis ad 0.3 mm. longis sericeo-tomentellis demum glabris, floribus desideratis; pedicello sub fructu incrassato ad 5 mm. diametro rugoso glabro 2–2.5 cm. longo, lobis persistentibus calycis 5 coriaceis deltoideis, circiter 5 mm. longis et latis, extus pallide puberulis vel glabris, intus pilis stramineis circiter 1 mm. longis dense hispido-sericeis; fructibus ut videtur falcato-ellipsoideis ad 9 cm. longis et 6 cm. latis, basi rotundatis et breviter stipitatis, 3-valvatis (valvis 2 quam altera majoribus), siccitate brunneis, pericarpio lignoso crasso, mesocarpio transverse fibroso 6–8 mm. crasso, endocarpio coriaceo pallido, seminibus oblongis circiter 4 cm. longis et 2 cm. latis.

VITI LEVU: Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15607* (A, TYPE), June 18, 1941 (tree 5 m. high, in forest; native name: *ronga*).

The discovery of a species of *Gonystylus* in Fiji is quite unexpected, as the genus has previously been thought to have a compact range in Malaysia, the Philippines, and the western portion of New Guinea. Although our material lacks flowers, there can be no doubt of its place in the genus, as indicated by the

leaf-texture, venation, etc., and the structure of the fruits. The conspicuously punctate leaf-blades distinguish the Fijian species from its allies, although several other species have a similar but less obvious punctation. The fact that the leaf-

Fig. 4. *Gonystylus punctatus;* *a.* branchlet from fruiting specimen, × ½; *b.* fruit, × ½; *c.* longitudinal section of dried fruit, × ½; *d.* portion of leaf-blade in transmitted light, showing distribution of the pellucid glands, × 1.

blades of the new species are gradually, rather than abruptly, narrowed toward the apex is also a distinguishing specific feature.

In referring *Gonystylus* to the Thymeliaceae, I follow the recent informative discussion of the family by Domke (in Bibl. Bot. **27** [Heft 111]: 1–151. 1934).

Phaleria Jack

Fiji seems to be a center of distribution in *Phaleria,* nine species being recognizable there; two of these species also occur in Samoa and Tonga, but no others are known from the Pacific east of the Solomons. Although the genus almost certainly occurs in the New Hebrides, no specimens appear to have been collected there up to the present. Of the two known Micronesian species, one is also found in the Philippines and the other is a related species. The early descriptions of the Fijian species were based on rather inadequate material, and therefore I am redescribing these and indicating their inter-relationship by a key to the species.

The Fijian species are difficult to separate; one finds that such characters as leaf-texture, shape, and size, position of inflorescence, length of peduncle, size and internal pubescence of perianth, shape of faucial scales, length of filaments, and pubescence of ovary are variable within a species and not very dependable. The only specific characters which are more or less constant appear to be the 4- or 5-merous condition of the flower, the external pubescence of the perianth (in one species), the degree of persistence of the floral bracts and their size, and, in some cases, the length of petioles.

Key to the Fijian species

Inflorescence spicate or pseudocapitate, the flowers occupying the ultimate 5–15 mm., the bracts none or very soon caducous; perianth 5-merous; fruit thick-walled, the pericarp woody; seaside plants ..... 1. *P. disperma.*

Inflorescence capitate, the flowers congested on a flattened or convex or subglobose receptacle, often enveloped by bracts (these sometimes soon caducous); fruit usually thin-walled, the pericarp succulent; forest plants.

Perianth conspicuously pale-pilose without, 5-merous ..... 2. *P. pubiflora.*

Perianth glabrous without, 4-merous.

Leaf-blades subsessile (petiole 1–2 mm. long), subcordate at base; inflorescences terminal or axillary on foliage-branchlets; floral bracts conspicuous, persistent past anthesis.

Perianth 37–43 mm. long; floral bracts (10–) 15–20 mm. long, (8–) 12–20 mm. broad; leaf-blades 8–12 cm. long, 2.5–4 cm. broad. ..... 3. *P. pulchra.*

Perianth 45–60 mm. long; floral bracts 7–10 mm. long, about 9 mm. broad; leaf-blades 9–20 cm. long, 3–7.5 cm. broad ..... 4. *P. ixorioides.*

Leaf-blades petiolate (petiole at least 3 mm. long, sometimes 2 mm. in *P. lanceolata*), sometimes subcordate at base but then obviously petiolate.

Floral bracts persistent past anthesis, often present in fruiting specimens.

Flowers often 2 or 3 per inflorescence, sometimes several; fruits usually solitary; floral bracts 4–6, the inner 3 or 4 subequal in size, oblong-ovate, longer than broad ..... 5. *P. montana.*

Flowers (5–) 10–20 per inflorescence; fruits several per head; floral bracts 2, ovate or broadly ovate, usually broader than long.

Leaf-blades chartaceous or subcoriaceous, elliptic-ovate or oblong-elliptic, 3 or 4 times as long as broad; floral bracts 6–12 mm. long, 8–16 (–21) mm. broad. 6. *P. glabra.*

Leaf-blades submembranous or papyraceous, lanceolate-oblong, 5 or 6 times as long as broad; floral bracts 5–8 mm. long and broad ..... 7. *P. angustifolia.*

Floral bracts caducous before anthesis.

Perianth 35–55 mm. long; flowers 6–25 (–35) per inflorescence; leaf-blades 7–20 (–24) cm. long, 2.5–8 (–11.5) cm. broad ..... 8. *P. acuminata.*

Perianth 27–30 mm. long; flowers usually 3 or 4 per inflorescence; leaf-blades 4–8.5 cm. long, 1–2.2 cm. broad ..... 9. *P. lanceolata.*

1. **Phaleria disperma** (Forst. f.) Baill. in Adansonia **11**: 318. 1875; Gilg in E. & P. Nat. Pfl. III. **6a**: 225. 1894.

Dais disperma Forst. f. Fl. Ins. Austr. Prodr. 33. 1786.

Leucosmia Burnettiana Benth. in Lond. Jour. Bot. **2**: 231. 1843; Benth. Bot. Voy. Sulphur 179. *pl. 57* (in some copies). 1846; Meisn. in DC. Prodr. **14**: 603. 1857; Seem. in Bonplandia **9**: 258. 1861; A. Gray in Jour. Bot. **3**: 306. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Drymispermum Forsteri Meisn. in DC. Prodr. **14**: 605. 1857.

Drymispermum Billardieri Dec. Bot. Voy. Venus 16. *pl. 12* (in Atlas). 1864.

Leucosmia ovata Dec. Bot. Voy. Venus 17. 1864.

Drymispermum Burnettianum Seem. Fl. Vit. 208. 1867.

Phaleria Burnettiana Knuth in Handb. d. Blutenbiol. **3**: 522. 1904; Christoph. in Bishop Mus. Bull. **154**: 19. 1938.

Seaside shrub or small tree, up to 8 m. high, the branchlets stout, subterete, rugulose when dried; petioles rugulose, shallowly canaliculate, 7–10 mm. long; leaf-blades subcarnose, dark green and shining when fresh, papyraceous and yellowish green when dried, oblong, 8–16 cm. long, 5–9.5 cm. broad, rounded to obtuse at base, acute or cuspidate at apex, the costa shallowly canaliculate above, prominent beneath, the secondary nerves 6–8 per side, spreading, prominulous or nearly plane above, sharply elevated beneath, the veinlet-reticulation prominulous or plane on both surfaces; inflorescences terminal on foliage-branchlets, solitary or rarely paired, spicate or pseudocapitate, the peduncle similar to the branchlets, 1.5–5 cm. long, usually bearing 2 inconspicuous oblong-lanceolate bracteoles about 2 mm. long near its base, the floral bracts apparently 2, soon caducous; flowers 10–15 per inflorescence, congested on a rachis 5–15 mm. long; perianth 40–53 mm. long, minutely pale-puberulent within, the lobes 5, elliptic-oblong, 6–9 mm. long, 3–5 mm. broad, obtuse at apex, minutely puberulent within, the faucial scales obscure, membranous, oblong-deltoid, 0.5–0.8 mm. long, obtuse at apex, sometimes apparently lacking; stamens 10, the filaments 0.5–4 mm. long, the anthers oblong, 1.6–2.7 mm. long; disk membranous, 0.5–1 mm. high, undulate at apex; ovary obscurely setose distally with pale hairs 0.3–0.7 mm. long, the stigma oblong-ellipsoid, about 2.5 mm. long; fruit at maturity ovoid-ellipsoid, 14–22 mm. long, 11–20 mm. broad, strongly rugose when dried, rounded at base, often subacute at apex, the pericarp woody, 4–6 mm. thick, the seeds 2 or rarely 1, about 7 mm. long and 6 mm. broad, the testa thin.

Ovalau: *Seemann 383* (GH); north of Levuka, *Gillespie 4491* (Bish, GH, NY, UC) (on seaside cliffs). Vanua Mbalavu: Northern limestone section, *Smith 1495* (Bish, GH, NY, UC, US) (shrub 4 m. high, on seaside cliffs; perianth white; native name: *sinu*). Kambara: *Bryan 496* (A, Bish) (tree 5–8 m. high, near beach; bark nearly smooth, light brown; sapwood moderately thick, cream; heartwood yellow-brown; native name: *sinu ndina*).

In addition to the cited specimens, I have seen material of the *U. S. Exploring Expedition* (GH) and *Harvey* (NY) from Samoa and Tonga; Seemann also mentions the species from Viti Levu and gives the native names of *sinu ndina* and *sinu ndamu*.

Gray (in Jour. Bot. 3: 305. 1865) first pointed out the fact that Forster's concept of *Dais disperma* appeared to be based on a mixture. He suggested that the specific name be maintained for the seacoast plant with 5-merous flowers, which had been subsequently described by Bentham as *Leucosmia Burnettiana*. Nevertheless, Gray did not formally transfer the specific epithet *disperma* to *Leucosmia*, which he maintained as a genus while pointing out that it should probably be reduced to *Drymispermum*. Gray then proceeded to describe a new species, *Leucosmia acuminata*, which he supposed to be the second element in Forster's concept. This typification of *Dais disperma* as synonymous with *Leucosmia Burnettiana* has been followed by most subsequent authors.

Drymispermum Billardieri is based on specimens collected in Tonga, *Leucosmia ovata* on a plant from Ovalau in Fiji; the identity of these plants with *Phaleria disperma* has been discussed at some length by Baillon (in Adansonia **11**: 317–319. 1875).

The seacoast plant which I have described above is an unmistakable species, clearly distinguished from others of the genus by having its flowers loosely arranged rather than strictly capitate. Bentham proposed to base his genus *Leucosmia* upon it because of the 5-merous flowers, the presence of faucial scales, the shape of the stigma, and the drupaceous fruit. These characters do not differentiate the species from others of *Phaleria* (or *Drymispermum*), since 5-merous flowers occur in other species and faucial scales are the rule.

2. **Phaleria pubiflora** (A. Gray) Gilg in E. & P. Nat. Pfl. III. **6a**: 225. 1894.

Leucosmia pubiflora A. Gray in Jour. Bot. **3**: 306. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Drymispermum pubiflorum Seem. Fl. Vit. 208. 1867.

Small tree, often cauliflorous, the branchlets slender, subterete, rugulose, cinereous; petioles shallowly canaliculate, 3–5 mm. long; leaf-blades subcoriaceous or chartaceous, ovate-oblong or ovate-lanceolate, 8–12 cm. long, 2.5–4.5 cm. broad, rounded or broadly obtuse at base, gradually narrowed to an acute or subacuminate apex, the costa shallowly canaliculate above, prominent beneath, the secondary nerves about 6 per side, arcuate, with the veinlet-reticulation prominulous on both surfaces; inflorescences axillary or arising from defoliate branchlets or main stem, the peduncles apparently fasciculate, 10–22 mm. long, with several inconspicuous deltoid bracteoles 0.5–1 mm. long near base, the floral bracts soon deciduous, probably 2, the receptacle convex; flowers 4–6 or perhaps more per inflorescence; perianth 35–40 mm. long, very slender toward base, pale-pilose without with weak hairs 0.2–0.5 mm. long, pale-tomentellous within, the lobes 5, oblong, 5–6 mm. long, 2–3 mm. broad, obtuse, puberulent on both surfaces, the faucial scales inconspicuous, deltoid, about 0.5 mm. long, subacute; stamens 10, the filaments 0.5–3 mm. long, the anthers oblong, about 1 mm. long; disk membranous, about 1.5 mm. high, crenulate at apex; ovary setulose distally with pale hairs about 0.7 mm. long, the stigma oblong-ellipsoid, about 2 mm. long; young fruit ovoid, 12–15 mm. long, 5–7 mm. broad, obtuse at base, acute at apex, the seed apparently solitary.

Viti Levu: Tholo North: Korovou, east of Tavua, alt. 60–150 m., *Degener 14951* (A) (cauliflorous tree 3 m. high, in dry dark ravine).

Originally based on a specimen of the U. S. Exploring Expedition, which is probably deposited in the herbarium of the British Museum, this species was reported by Seemann from Kandavu, on the basis of his no. *379*. Although I have seen neither of the early collections, the Degener plant agrees with the descriptions in its pilose 5-merous perianth and seems certainly to represent the species. The above description is drawn up from the latter specimen, the original descriptions omitting references to dimensions.

3. **Phaleria pulchra** Gillespie in Bishop Mus. Bull. **91**: 21. *pl. 23*. 1932.

Viti Levu: Naitasiri: Tamavua woods, 7 miles from Suva, alt. 150 m., *Gillespie 2141* (A, Bish, type, GH, UC).

Since no material of this species has been collected since the type, the original description is adequate. The species is well marked by its very short petioles, subcordate leaf-blades, and conspicuous floral bracts.

4. **Phaleria ixorioides** Fosberg in Bull. Torrey Bot. Club **67**: 418. 1940.

WAYA (Yasawa Group): North of Yalombi, along Olo Creek, *St. John 18123* (Bish, TYPE) (small tree 5 m. high, in woods by stream; flowers fragrant, the perianth white; native name: *tarutaru*). VITI LEVU: Serua: Vatutavathe, vicinity of Ngaloa, alt. 150 m., *Degener 15202* (A) (tree 4–6 m. high, in forest; flowers abundant, in dense clusters, the perianth white).

The original description amply portrays this species, which is closely related only to *P. pulchra*, from which it is distinguished primarily by the dimensional characters mentioned in the key.

5. **Phaleria montana** (Seem.) Gilg in E. & P. Nat. Pfl. III. **6a**: 225. 1894.

Drymispermum montanum Seem. in Bonplandia **9**: 258, nomen. 1861; Mission to Viti 440, nomen. 1862; Fl. Vit. 209. *pl. 54*. 1867.

Leucosmia montanum Benth. & Hook. ex Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Small slender tree, the branchlets subterete, rugulose, cinereous, often swollen at nodes; petioles rugulose, canaliculate, 3–6 mm. long; leaf-blades chartaceous, olivaceous or dark green when dried, elliptic-ovate, 7–11 cm. long, 2.5–5 cm. broad, obtuse at base, acute or gradually short-acuminate at apex, the costa impressed or nearly plane above, prominent beneath, the secondary nerves 6–8 per side, arcuate, prominulous above, acutely elevated beneath, the veinlet-reticulation prominulous on both surfaces; inflorescences axillary toward apices of branchlets, solitary or aggregated in groups of 2–5, the peduncle 3–15 mm. long, with a few deltoid to linear bracteoles 1–2 mm. long near its base, sometimes bibracteolate near middle, the bracteoles caducous; floral bracts 4–6, imbricate, papyraceous or submembranous, oblong-ovate, the outer 2 or 3 about 4 mm. long and 3 mm. broad, the inner 3 or 4 obscurely nerved, 9–14 mm. long, 5–8 mm. broad, rounded or obtuse at apex; receptacle convex, the flowers often 2 or 3 per inflorescence, sometimes several; perianth slender, puberulent within, the lobes 4, ovate, acute, puberulent on both surfaces, the faucial scales oblong, erose-truncate at apex; stamens 8, the anthers oblong; ovary glabrous or distally sparsely setose with a few pale hairs; fruit usually 1 per inflorescence at maturity, oblong-ellipsoid, 8–12 mm. long, 7–10 mm. broad, rounded at base, obtuse at apex, the seeds 1 or 2.

VITI LEVU: Tholo North: Nandarivatu, alt. 800 m., *Gillespie 4186* (Bish, GH, NY, UC) (in wooded ravines at head of escarpment north of Government house); Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15336* (A) (tree 3 m. high, in forest; fruit red, shiny), *Degener 15426* (A) (in forest); Tuvavatu, near Rewasa, alt. 50–200 m., *Degener 15377* (A) (small tree or large shrub, in forest; native name: *sinu matiavi*).

The cited specimens are the only ones I have seen which agree with Seemann's description and plate in having several, rather than two, floral bracts. Although I have not seen the type collection (*Seemann 380* from Kandavu), the species seems to be well characterized by these bracts, which differ in proportions from those of *P. glabra*. In other respects the two species are difficult to separate. Mature flowers are not available to me, and Seemann did not give their dimensions.

6. **Phaleria glabra** (Turrill) Domke in Bibl. Bot. **27**(Heft 111): 55. 1934.

Leucosmia glabra Turrill in Jour. Linn. Soc. Bot. **43**: 37. 1915.

Slender shrub or small tree, the branchlets subterete, rugulose; petioles canaliculate, rugulose, 5–12 mm. long; leaf-blades subcoriaceous to papyraceous, usually olivaceous when dried, ovate-elliptic or oblong, 7–21 cm. long, (2–) 3–9 cm. broad, obtuse or acute (rarely rounded) at base, gradually acuminate or cuspidate at apex, often conspicuously recurved at margin, the costa shallowly impressed above, prominent beneath, the secondary nerves 5–10 (–13) per side, arcuate or spreading, prominulous above, slightly elevated beneath, the veinlet-reticulation prominulous or immersed on both surfaces; inflorescences axillary or on defoliate

branchlets, solitary, the peduncle 2–8 mm. long, with several papyraceous deltoid-linear caducous bracteoles 1–3 mm. long toward its base; floral bracts 2, persistent past anthesis, subcoriaceous or papyraceous, broadly ovate, 6–12 mm. long, 8–16 (–21) mm. broad, rounded or rarely subacute at apex, obscurely nerved; receptacle convex or flattened or subcapitate, the flowers (5–) 10–20 per inflorescence; perianth 30–55 mm. long, hispid-pilose or tomentellous within with weak pale hairs 0.5–1 mm. long, the lobes 4, oblong, 4.5–9 mm. long, 2.5–5 mm. broad, obtuse or rounded at apex, puberulent within, the faucial scales oblong or oblong-deltoid, 0.5–1.5 mm. long, subacute to erose-truncate at apex; stamens 8, the filaments slender, 1–3 mm. long, the anthers oblong, 1.2–1.5 mm. long; disk membranous, 1.2–2 mm. high, crenulate at apex; ovary glabrous or sparsely setose distally with a few pale hairs about 0.6 mm. long, the stigma oblong-ellipsoid, 1–3 mm. long; fruits several per inflorescence, oblong-ellipsoid or obovoid, 7–15 mm. long, 5–11 mm. broad, rounded to subacute at base, obtuse at apex, the pericarp thin, the seed 1 or rarely 2.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 750–900 m., *Gillespie 3708* (Bish, GH, UC) (floral bracts green; flowers fragrant, the perianth white), *Gillespie 3987* (Bish, UC), *Gillespie 4199* (Bish, UC), *Degener 14734* (A) (tree 3 m. high, in forest; fruit dark red); Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15562* (A) (native name: *mbuimbuita*); Namosi: Naitarandamu Mt., alt. 1100 m., *Gillespie 3362* (Bish, GH, NY, UC); Rewa: Near Lami, alt. 10 m., *Gillespie 4614* (Bish, UC); Naitasiri: Tamavua woods, alt. 150 m., *Gillespie 2420* (Bish, GH, UC); Nasinu, alt. 150 m., *Gillespie 3583* (Bish, GH, UC) (slender shrub 2 m. high), *Gillespie 3666* (Bish, UC) (fruit bright red). Vanua Levu: Thakaundrove: Vatunivuamonde Mt., Savu Savu Bay region, alt. 300 m., *Degener & Ordonez 14032* (A), *14035* (A) (shrubs 2 m. high, in dense forest; fruit red); Yanawai River region, Mt. Kasi, alt. 300–430 m., *Smith 1819* (Bish, NY) (slender shrub 3 m. high, in dense forest; fruit red).

Although I have not seen the type collection of this species (*im Thurn 12* from Kandavu), the cited specimens agree well with the original description; Turrill also remarks that the species is common about Nandarivatu. The species is very variable in leaf-size and texture, but the broad persistent paired bracts, borne on short peduncles arising from the slender branchlets, adequately characterize it.

7. **Phaleria angustifolia** A. C. Sm. in Bishop Mus. Bull. **141**: 101. *f. 53.* 1936.

Vanua Levu: Mbua: Southern slope of Mt. Seatura, alt. 500 m., *Smith 1685* (Bish, TYPE, GH, NY, UC, US) (slender tree 4 m. high; flowers borne on trunk and branches; perianth white; native name: *numbu*).

Since only one collection of this species is known, the original description is adequate. It is a species showing affinities with both *P. glabra* and *P. acuminata*, but readily recognized by its narrow leaves and small but persistent floral bracts.

8. **Phaleria acuminata** (A. Gray) Gilg in E. & P. Nat. Pfl. III. **6a**: 225. 1894; Christoph. in Bishop Mus. Bull. **154**: 18. 1938.

Leucosmia acuminata A. Gray in Jour. Bot. **3**: 306. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Drymispermum subcordatum Seem. in Bonplandia **9**: 258, nomen. 1861; Mission to Viti 440, nomen. 1862; Fl. Vit. 209. *pl. 53.* 1867.

Drymispermum acuminatum Seem. Fl. Vit. 209. 1867.

Leucosmia subcordata Benth. & Hook. ex Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Phaleria subcordata Gilg in E. & P. Nat. Pfl. III. **6a**: 225. 1894.

Slender shrub or tree, to 9 m. high, often cauliflorous, the branchlets slender, subterete; petioles rugulose, canaliculate, 4–17 mm. long; leaf-blades chartaceous or papyraceous or submembranaceous, usually olivaceous when dried, ovate-elliptic or oblong, 7–20 (–24) cm. long, 2.5–8 (–11.5) cm. broad, subacute to subcordate at base, acute or gradually acuminate or cuspidate at apex, the costa slightly im-

pressed above, prominent beneath, the secondary nerves 7–12 per side, arcuate, spreading or ascending, prominulous or conspicuously elevated on both surfaces, the veinlet-reticulation prominulous on both surfaces; inflorescences axillary or subterminal, often on defoliate branches or trunk, solitary or paired, the peduncle 3–10 (–30) mm. long, with several inconspicuous oblong-linear or deltoid bracteoles 0.5–2 mm. long toward its base; floral bracts 2, papyraceous, orbicular-ovate, about 3 mm. long and broad, rounded at apex, caducous before anthesis; receptacle convex or subglobose, the flowers 6–25 (–35) per inflorescence; perianth 35–55 mm. long, sparsely pilose within with weak hairs 0.5–1 mm. long, the lobes 4, oblong or elliptic-oblong, 6–9 mm. long, 2–5 mm. broad, obtuse or rounded at apex, puberulent within and sometimes without, the faucial scales membranous, oblong, 0.7–1.3 mm. long, erose-truncate to subacute at apex; stamens 8, the filaments 0.5–4.5 mm. long, the anthers oblong, 1–1.7 mm. long; disk membranous, 0.7–1.5 mm. high, undulate at apex; ovary distally pilose with weak pale hairs 0.5–0.8 mm. long, sometimes essentially glabrous, the stigma oblong-ellipsoid, 1–4.5 mm. long; fruits at maturity usually 3–6 per inflorescence, obovoid or subglobose-ellipsoid, usually 2-seeded and slightly flattened, sometimes 1-seeded and slightly falcate, (7–) 16–28 mm. long, (6–) 10–20 mm. broad, rounded or obtuse at base, obtuse or subacute at apex, the pericarp thin, fleshy.

WAKAYA: *Beck* (Bish). VANUA LEVU: Thakaundrove: Eastern drainage of Yanawai River, alt. 90 m., *Degener & Ordonez 14121* (A) (cauliflorous shrub to 3 m. high, in open forest; perianth white); southern slopes of Korotini Range, alt. 300–650 m., *Smith 488* (Bish, GH, NY, UC, US) (tree 5 m. high; flowers fragrant, the perianth pure white; native name: *songo ni wai*), *Smith 494* (Bish, GH, NY, UC, US) (shrub 4 m. high; native name: *toatoa*); southwestern slope of Mt. Mbatini, alt. 300–700 m., *Smith 621* (Bish, NY) (slender cauliflorous shrub 1–2 m. high; perianth white), *Smith 672* (Bish, NY) (slender shrub 1 m. high; perianth white; anthers yellow; fruit red); Mt. Mariko, alt. 600–800 m., *Smith 450* (Bish, GH, NY, UC, US) (slender tree 9 m. high; fruit deep red); hills south of Nakula Valley, alt. 10–30 m., *Smith 336* (Bish, GH, NY, UC, US) (slender tree 3 m. high; fruit red); Uluinabathi Mt., Savu Savu Bay region, alt. 90–180 m., *Degener & Ordonez 13930* (A) (slender cauliflorous tree 4 m. high, in dense forest), *Degener & Ordonez 14198* (A) (tree or shrub 2 m. high, in open forest; fruit red, shiny); Maravu, near Salt Lake, alt. 75 m., *Degener & Ordonez 14235* (A). TAVEUNI: Borders of lake east of Somosomo, alt. 700–900 m., *Smith 928* (Bish, NY) (shrub 3 m. high, in dense forest; perianth white). MOALA: Near Maloku, alt. 300 m., *Smith 1338* (Bish, NY) (slender tree 7 m. high, in forest; fruit deep red; native name: *kau ndamu*). YANGASA CLUSTER: Navutu i loma, *Bryan 456* (A, Bish) *457* (A, Bish) (shrubs or small trees 3–4 m. high; fruit red to purple); Navutu i ra, *Bryan 467* (A, Bish) (scandent tree 4–5 m. high; fruit green to red-purple). WITHOUT DEFINITE LOCALITY: *Tothill 546* (Bish).

Seemann has reported this species from Viti Levu, from which the Tothill specimen presumably comes, but it is noteworthy that the species appears to be abundant on Vanua Levu and rare on the larger island. The cited specimens have been compared with Samoan and Tongan material, including a *U. S. Expl. Exped.* (NY, US) sheet from Samoa which is presumably from the type collection, although Gray reports the species from "Samoan and Fijian Islands." Although the type collections of *Drymispermum subcordatum* (*Seemann 381* and *383* [in part, presumably] from Rewa, Viti Levu, and Taveuni) have not been seen, several of the cited specimens precisely agree with Seemann's plate.

I have attempted in vain to find characters which would serve to distinguish *P. subcordata* from *P. acuminata.* The leaf-base is variable, even on the same individual; the degree of pubescence inside the perianth and on the ovary is also variable, the ovary being from glabrous to distally setose on plants which are otherwise quite identical. Number of flowers per inflorescence is not dependable since the inflorescences associated with the apical leaves generally have 6–10 flowers, whereas those farther down on the branchlets or on the main stems commonly

have 20–35 flowers. The fruits of most Fijian specimens are very large and generally 2-seeded, but the specimens collected by Bryan in the Yangasa Cluster have fairly small fruits, which are usually 1-seeded and not more than 10 mm. long at maturity. However, in all other respects these Bryan collections are similar to others from Fiji. Leaf-texture is variable and is apparently due to shade conditions; however, the leaves are never as thick as those of *P. glabra.*

Phaleria acuminata, when non-essential characters are excluded from consideration, is rather weakly characterized by its quickly caducous floral bracts, usually large fruits, and large comparatively thin and usually acuminate leaf-blades. The common names of *sinu matiavi* and *matiavi* are listed by Seemann.

9. **Phaleria lanceolata** (A. Gray) Gilg in E. & P. Nat. Pfl. III. **6a:** 225. 1894.
Drymispermum lanceolatum A. Gray in Jour. Bot. **3:** 304. 1865; Seem. Fl. Vit. 208. 1867.
Leucosmia lanceolata Benth. & Hook. ex Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Slender shrub, the branchlets rugulose, slightly swollen at nodes; petioles slender, shallowly canaliculate, 2–5 mm. long; leaf-blades chartaceous or papyraceous, oblong-lanceolate, 4–8.5 cm. long, 1–2.2 cm. broad, obtuse at base, gradually narrowed to an acute or subacute apex, the costa slightly impressed above, conspicuous beneath, the secondary nerves 5–8 per side, ascending, with the veinlet-reticulation prominulous on both surfaces; inflorescences terminal or axillary or arising from defoliate branchlets, solitary, the peduncle 2–15 mm. long, with several inconspicuous deltoid-lanceolate bracteoles about 1 mm. long near its base and others to 4 mm. long near middle; floral bracts 2, papyraceous, ovate, 5–6 mm. long and broad, subacute at apex, obscurely nerved, caducous before anthesis; receptacle convex, the flowers usually 3 or 4 per inflorescence; perianth 27–30 mm. long, faintly pale-puberulent within with hairs about 0.5 mm. long, the lobes 4, ovate-oblong, 5–6 mm. long, 3–4 mm. broad, subacute at apex, puberulent within, the faucial scales very inconspicuous or apparently none; stamens 8, the filaments 0.6–1 mm. long, the anthers oblong, 1–1.2 mm. long; disk submembranous, about 0.6 mm. high, faintly crenulate at apex; ovary faintly hispid distally with a few pale hairs about 0.5 mm. long, the stigma oblong-ellipsoid, about 2 mm. long.

VANUA LEVU: Mathuata: "Mountains behind Mathuata" [presumably the mainland opposite the islet of that name], *U. S. Expl. Exped.* (US, TYPE); Mbua: Ruku Ruku Bay, *Parham 11* (A) (rambling shrub).

This attractive and apparently rare shrub is readily distinguished from *P. acuminata* by the characters mentioned in the key.

LYTHRACEAE

Cuphea carthagenensis (Jacq.) Macbr. in Field Mus. Publ. Bot. **8:** 124. 1930.

VITI LEVU: Nandronga: Government Farm, Singatoka, *Greenwood 786B* (A) (in wet places in fields).

This American weed has not previously been reported from Fiji, although it is known from Samoa and other Pacific groups, having usually been reported as *C. balsamona* Cham. & Schlecht. The present determination is by Dr. R. C. Foster.

The family Lythraceae, to the best of my knowledge, has not previously been recorded from Fiji.

Pemphis acidula Forst. Char. Gen. 68. *pl. 34.* 1776; Guillaumin in Jour. Arnold Arb. **12:** 261. 1931; Christoph. in Bishop Mus. Bull. **128:** 154. 1935.

VANUA LEVU: Thakaundrove: Waina, Maravu, near Salt Lake, *Degener & Ordonez 14165* (A), *14189* (A) (small trees, along coast; native name: *sanggale*). KORO:

East coast, *Smith 1033* (GH, NY) (shrub 4 m. high, among rocks along shore; native name: *sanggali*). Fulanga: *Smith 1202* (GH, NY) (gnarled tree 1–2 m. high, on limestone cliff in lagoon; native name: *ngingia*).

Although *P. acidula* is reported as common in many Pacific groups, this is apparently the first record of it from Fiji.

Lawsonia inermis L. Sp. Pl. 349. 1753; Safford in Contr. U. S. Nat. Herb. **9**: 306. 1905.

Viti Levu: Rewa: Vicinity of Suva, *Degener & Ordonez 13627* (A) (cultivated tree).

It seems advisable to record this widely cultivated plant from Fiji, as it may become naturalized; it has doubtless been introduced from India.

COMBRETACEAE

Terminalia vitiensis sp. nov.

Arbor multiramosa ad 8 m. alta floribus intus exceptis glabra, ramulis subteretibus cinereis rugosis; foliis apicem ramulorum versus confertis, petiolis gracilibus 8–15 mm. longis superne anguste alatis, laminis chartaceis in sicco viridibus ellipticis vel subobovato-ellipticis, 4–7 cm. longis, 1.5–3.2 cm. latis, basi attenuatis et in petiolum decurrentibus, apice rotundatis vel leviter emarginatis vel obtusis, margine integris et paullo incrassatis, supra minute pustulatis, costa supra paullo subtus valde elevata, nervis lateralibus utrinsecus 4–7 marginem versus curvatis utrinque prominulis, rete venularum laxo utrinque subimmerso vel leviter prominulo; inflorescentiis axillaribus racemosis 6–10 cm. longis, pedunculo brevi et rhachi gracilibus, floribus numerosis pedicellatis, pedicellis gracilibus 2–4 mm. longis apicem versus incrassatis; calyce infundibuliformi 3–4 mm. longo tenuiter carnoso intus pallide tomentello, lobis 5 acutis deltoideis 1.5–2 mm. longis et latis; lobis disci 5 carnosis hirsutis; staminibus 8–11, filamentis filiformibus glabris sub anthesi circiter 7 mm. demum ad 10 mm. longis, antheris oblongis 0.8–1 mm. longis, loculis apicem versus distinctis; ovarii rudimento nullo vel subfiliformi glabro ad 7 mm. longo.

Viti Levu: Serua: Near Mt. Ngamo, vicinity of Ngaloa, alt. about 75 m., *Degener 15081* (A, type), Apr. 25, 1941 (densely branched tree about 8 m. high, in forest; flowers pale yellow).

Terminalia vitiensis is of the relationship of the Samoan *T. Richii* A. Gray, from which it differs in its essentially rounded rather than acuminate leaf-apex, its glabrous rather than tomentellous rachis, and its pedicellate rather than sessile flowers.

MYRTACEAE

By E. D. Merrill and L. M. Perry

Syzygium Gaertner

Many generic concepts, both limited and comprehensive, have been published for the fleshy-fruited Myrtaceae. Of these the largest Old World genus is *Syzygium* Gaertner. In our study of the Bornean material, we did not accept the traditional limits of the genus. After trying to evaluate the characters and variations in the group, we adopted a broadened concept for *Syzygium* based on Gaertner's original description of the fruit rather than on the more fickle floral characters which had been most influential in determining the traditional status of the genus. At that time *Pareugenia* Turrill came to our attention. Apart from the united filaments, the material looked so much like *Syzygium fastigiatum* (Bl.) Merr. & Perry in all its other characters that we were dubious of its generic distinction. However, since we had found no other instance of the coalescence or

connate condition of the filaments, we decided to let it wait for future consideration. In our study of *Syzygium* in Papuasia we found more than one species with filaments united in varying degrees. *Syzygium Schumannianum* (Nied.) Diels (*Eugenia neurocalyx* K. Schum.) is described as having stamens connate in four phalanges; we have seen no flowering material. In *Eugenia coalita* Greves, Jour. Bot. **61**: Suppl. 15. 1923, according to the description, the outer filaments have coalesced and are subpetaloid. We found a similar situation in *S. spectabile* Merr. & Perry; the outer filaments are united in varying degrees more or less half their length, the inner stamens are single or in tiny phalanges of 2 or 3. It must be admitted that in these larger flowers the stamens appear for the most part *en masse* rather than broken up into phalanges; nevertheless, this is a condition of coalescence of the filaments whether the stamens appear as a mass or whether they appear to be broken up into from four to sixteen phalanges, or are both single and in phalanges as in *Pareugenia oligadelpha* Christophersen. That is to say, we consider this a highly variable character and for this reason scarcely worthy in generic consideration. Until further collections offer some more stable character we believe the species ascribed to *Pareugenia* Turrill belong in our concept of the genus *Syzygium* Gaertner.

Syzygium Brackenridgei (A. Gray) C. Muell. in Walp. Ann. **4**: 838. 1857.

Eugenia Brackenridgei A. Gray, Bot. U. S. Expl. Exped. **1**: 521. *pl. 61A*. 1854.

Jambosa Brackenridgei Brongn. & Gris in Bull. Soc. Bot. Fr. **12**: 181. 1865.

Pareugenia Brackenridgei A. C. Sm. in Bishop Mus. Bull. **141**: 109. 1936.

OVALAU: *U. S. Expl. Exped.* (GH). KANDAVU: Mount Mbuke Levu, dense forest, alt. 200–500 m., *Smith 239* (GH). WITHOUT DEFINITE LOCALITY: *Horne 689, 843, 867, 936* (all GH).

Syzygium oblongifolium (Gillespie) Merr. & Perry, comb. nov.

Pareugenia oblongifolia Gillespie in Bishop Mus. Bull. **83**: 23. *f. 29*. 1931.

VANUA LEVU: Mbua: Lower Wainunu River valley, thin forest, alt. 0–200 m., *Smith 1723* (GH). WITHOUT DEFINITE LOCALITY: *Horne* (GH).

Syzygium Imthurnii (Turrill) Merr. & Perry, comb. nov.

Pareugenia Imthurnii Turrill in Jour. Linn. Soc. Bot. **43**: 21. 1915; in Hook. Ic. Pl. **31**: *pl. 3004*. 1915.

VITI LEVU: Lautoka: Mountains near Lautoka, *Greenwood 36* (A).

Syzygium oligadelphum (Christoph.) Merr. & Perry, comb. nov.

Pareugenia oligadelpha Christoph. in Bishop Mus. Bull. **154**: 20. *f. 6*. 1938.

SAMOA: UPOLU. Specimen not seen.

Syzygium nomoa Guillaumin in Jour. Arnold Arb. **12**: 258. 1931, of the New Hebrides, also belongs in this group with stamens more or less united into phalanges, although this fact is overlooked in the original description.

Syzygium Wolfii (Gillespie) Merr. & Perry, comb. nov.

Eugenia Wolfii Gillespie in Bishop Mus. Bull. **83**: 22. *f. 28*. 1931; A. C. Sm. op. cit. **141**: 106. 1936.

VANUA LEVU: Mathuata: Wainunu-Ndreketi Divide, alt. 200–300 m., *Smith 1854* (GH) (slender tree 20 m. high); Mbua: *Horne 1100* (GH).

Syzygium curvistylum (Gillespie) Merr. & Perry, comb. nov.

Eugenia curvistyla Gillespie in Bishop Mus. Bull. **83**: 21. *f. 26*. 1931.

VANUA LEVU: Thakaundrove: Southwestern slope of Mount Mbatini, dense forest, alt. 300–700 m., *Smith 609* (GH) (tree 18 m. high); Mbua: Upper Ndama River valley, dense forest, 100–300 m., *Smith 1598* (GH) (tree 10 m. high; flower-buds pale green). TAVEUNI: Western slope, between Somosomo and Wairiki, woods along stream, alt. 300 m., *Smith 839* (GH) (tree 9 m. high; flowers white; fruit deep purple).

Syzygium Seemannianum Merr. & Perry, nom. nov.

Eugenia rivularis Seem. Fl. Vit. 80. 1865; non *Syzygium rivulare* Vieill. ex Guillaumin in Bull. Soc. Bot. Fr. **85**: 645. 1938.

Viti Levu: Tholo North: Vicinity of Nandarivatu, along streams, occasionally on flooded land, *Degener 14272a* (A) (shrub or small tree 1–3 m. high; flowers white with greenish yellow tinge; fruit black); Serua: Navua River, *Seemann 162* (GH, isotype). Without definite locality: *Horne 920* (GH).

Syzygium durifolium (A. C. Sm.) Merr. & Perry, comb. nov.

Eugenia durifolia A. C. Sm. in Bishop Mus. Bull. **141**: 105. *f. 56.* 1936.

Taveuni: Borders of lake east of Somosomo, dense forest, alt. 700–900 m., *Smith 919* (GH, isotype).

Syzygium diffusum (Turrill) Merr. & Perry, comb. nov.

Eugenia diffusa Turrill in Jour. Linn. Soc. Bot. **43**: 20. 1915; A. C. Sm. in Bishop Mus. Bull. **141**: 107. 1936.

Syzygium aneityense Guillaumin in Jour. Arnold Arb. **12**: 256. 1931.

Kandavu: Mount Mbuke Levu, dense forest, alt. 200–500 m., *Smith 224* (GH) (tree 20 m. high; fruit on trunk, orange-colored). Taveuni: Western slope, between Somosomo and Wairiki, forest, alt. 500–900 m., *Smith 755, 769, 797* (all GH) (tree 13–20 m. high; flower-buds yellowish; fruit red). Koro: Eastern slope of main ridge, dense forest, alt. 300–500 m., *Smith 994* (GH) (tree 18 m. high; stamens white; fruit red; lumber valued for underwater uses). Without definite locality: *Horne 443* (GH).

Superficially the species closely resembles *Syzygium corynocarpum* (A. Gray) C. Muell. On comparing the flowers, however, it will be found that the lower part of the calyx in the latter species is much longer and tends to be fusiform-clavate in bud, crowned by a globose apex. On the other hand, in *S. diffusum* the base of the calyx is relatively short above the articulation with the pedicel, the bud being much nearer pyriform. We have been unable to distinguish the Fijian collections of this from an isotype of *S. aneityense* Guillaumin of the New Hebrides.

Syzygium Grayi (Seem.) Merr. & Perry, comb. nov.

Eugenia Grayi Seem. Fl. Vit. 79. *pl. 16.* 1865.

Viti Levu: Tholo North: Nakutu, Navai, alt. 750–900 m., *Degener 15028* (A); Mataivisai, Navai, alt. 750–900 m., *Degener 15029a* (A); Nandrau, vicinity of Nandarivatu, in forest, alt. 750–900 m., *Degener 14092* (A); Mount Matomba, Nandala, vicinity of Nandarivatu, in rich forest, alt. 750–900 m., *Degener 14455* (A). Kandavu: *Seemann 163* (GH, isotype). Vanua Levu: Thakaundrove: Between Valanga and Valethi, Savu Savu Bay region, alt. 0–400 m., *Degener & Ordonez 14039* (A); Maravu, near Salt Lake, forest, alt. 0–450 m., *Degener & Ordonez 14161* (A); Yanawai River region, Mount Kasi, dense forest, alt. 300–430 m., *Smith 1803* (GH) (slender tree 5 m. high; calyx and petals pinkish; stamens white, fruit rich pink); hills between Vatukawa and Wainingio Rivers, Ndrekeniwai Valley, forest, alt. 200–500 m., *Smith 592* (GH). Without definite locality: *Horne 742, 758* (both GH).

The collections from Vanua Levu show considerable variation in the length of the petiole, one collection having practically sessile leaves, the others with petioles up to 1.5 or almost 2 cm. long, with the leaf-base varying from cordate to cuneate. These are wide differences to allow in one specific concept, but the inflorescences seem to be similar and we believe that further material is needed before we can be sure of the limits of species variation here.

Syzygium simillimum Merr. & Perry, sp. nov.

Arbor parva 3 m. alta; ramulis teretibus brunnescentibus; foliis coriaceis impellucidis pallide viridescentibus sessilibus oblongis vel oblongo-lanceolatis, 12–17 cm. longis, 3–5 cm. latis, basi cordatis, apice obtuse acuminatis vel acutiusculis, costa supra leviter canaliculata subtus elevata, nervis primariis utrinque incon-

spicuis patentibus circiter 5–10 mm. inter se distantibus paullo irregularibus in venam intramarginalem inconspicuam 2–3 mm. a margine confluentibus; petiolo brevissimo; inflorescentiis terminalibus fere a basi ramosis vel breviter pedunculatis, ± 2.5 cm. longis, paucifloris, ramis ± 5 mm. longis; floribus breviter pedicellatis, crebre et minute glanduloso-pustulatis; alabastris pyriformibus 6 mm. longis in parte superiore 3–4 mm. diametro; calycis lobis 1.5 mm. longis obtusiusculis; petalis staminibusque non visis; stylo ± 1.5 cm. longo; fructibus circiter 8 mm. longis subgloboso-ovoideis calycis lobis coronatis.

VANUA LEVU: Thakaundrove: Eastern drainage of Yanawai River, in dark forest, alt. 20–160 m., *Degener & Ordonez 14093* (A, TYPE), Jan. 12, 1941 (sparingly branched tree 3 m. high; sepals pink; petals pale green; fruit dark red).

The species shows a remarkably strong resemblance to *Syzygium Beccarii* (Ridl.) Merr. & Perry, of Sarawak, Borneo. It differs in that the leaves show no glandular punctations, the venation is less obvious, and the primary veins are somewhat more remote. The flower-buds are slightly narrower and the calyx-lobes a little longer than in the Bornean collection.

Syzygium nidie Guillaumin in Jour. Arnold Arb. **12**: 257. 1931.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, dense forest, alt. 750–900 m., *Degener 14550* (A); Sovutawambu, near Nandarivatu, alt. 750–800 m., *Degener 14665* (A).

The flowers are very slightly smaller, and the inflorescences are scarcely as long and a little more compact than those of the type-collection from Aneityum in the New Hebrides. The specimens, however, do not show any specific differences.

Syzygium Richii (A. Gray) Merr. & Perry, comb. nov.

Eugenia Richii A. Gray, Bot. U. S. Expl. Exped. **1**: 510. *pl. 58*. 1854; Seem. Fl. Vit. 77. 1865.

Jambosa Richii C. Muell. in Walp. Ann. **4**: 849. 1857.

VITI LEVU: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15490* (A); Namosi: Between Namosi and Navua River, *Seemann 164, 165* (both GH). MOALA: Forest near Maloku, alt. 200 m., *Smith 1380* (GH) (tree 10 m. high; petals white; filaments bright yellow). VANUA LEVU: Thakaundrove: Savu Savu Bay region, alt. 0–150 m., *Degener & Ordonez 13884* (A); Mbua: Upper Ndama River valley, dense forest, near streams, alt. 100–300 m., *Smith 1693* (GH). VANUA MBALAVU: Northern limestone section, alt. 0–200 m., *Smith 1498* (GH) (tree 9 m. high; petals cream-white; filaments yellow). KAMBARA: Limestone formation, forest, alt. 0–100 m., *Smith 1255* (GH) (tree 17 m. high; petals and filaments cream-white). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (GH, ISOTYPES); *Horne 914, 1081* (both GH).

There is considerable variation in the foliage of this material, but we still do not have a sufficient number of collections to determine whether the narrower leaved material is a distinct species or not. We have seen no material of *Eugenia nandarivatensis* Gillespie (in Bishop Mus. Bull. **83**: *22. f. 27.* 1931), but from the figure we suspect it to be a segregate of *Syzygium Richii*. We do not care to try to evaluate it without authentic material for examination. It should be noted that *Eugenia Suzukii* Kaneh., of Palau, is remarkably like *Syzygium Richii;* further material is necessary to determine whether Kanehira's species is specifically different or not.

Syzygium quadrangulatum (A. Gray) Merr. & Perry, comb. nov.

Eugenia quadrangulata A. Gray, Bot. U. S. Expl. Exped. **1**: 511. 1854; Seem. Fl. Vit. 78. 1865.

Jambosa quadrangulata C. Muell. in Walp. Ann. **4**: 849. 1857.

VITI LEVU: Ra: Tuvavatu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15382* (A). OVALAU: *U. S. Expl. Exped.* (GH, ISOTYPE). WITHOUT DEFINITE LOCALITY: *Horne 340* (GH).

Syzygium gracilipes (A. Gray) Merr. & Perry, comb. nov.

Eugenia gracilipes A. Gray, Bot. U. S. Expl. Exped. **1**: 513. 1854; Seem. Fl. Vit. 78. *pl. 15.* 1865.

Jambosa gracilipes C. Muell. in Walp. Ann. **4**: 849. 1857.

Viti Levu: Tholo North: Mount Matomba, Nandala, vicinity of Nandarivatu, in dense rich forest, alt. 750–900 m., *Degener 14433* (A); Nauwanga, vicinity of Nandarivatu, in dense forest, alt. 750–900 m., *Degener 14808* (A) (tree 2 m. high; fruit red, globose-pyriform, about 4 cm. diameter and 3- or 4-seeded; seeds about 1.5 cm. diameter); Tholo West: Mbuyombuyo, forest, *Tabualewa 15591, 15606* (both A) (fruit bright red); Lautoka: North of Lomolomo, dense forest, alt. 0–150 m., *Degener & Ordonez 13638* (A) (shrub 2 feet high, spreading; fruit pink); Serua: Vatuvilakia, vicinity of Ngaloa, alt. 150 m., *Degener 15142* (A). Without definite locality: *Seemann 158* (GH), *U. S. Expl. Exped.* (GH, isotype).

Possibly *Smith 236* (GH) from Kandavu also belongs here. In this specimen the fruit is separate from a young shoot, but the vegetative characters agree fairly well with those of the species.

Syzygium vitiense (Turrill) Merr. & Perry, comb. nov.

Eugenia vitiensis Turrill in Jour. Linn. Soc. Bot. **43**: 21. 1915.

We have seen no material that conforms to the characters of Turrill's species. The type was from Kandavu, on the way up Mt. Mbuke Levu.

Syzygium Gillespiei Merr. & Perry, sp. nov.

Probabiliter arbuscula vel frutex; ramulis novellis 4-angulatis vel compressis brunnescentibus; foliis coriaceis impellucidis opacis supra olivaceis minute punctatis subtus brunnescentibus lanceolatis vel ellipticis, 20–28 cm. longis, 4–10 cm. latis, basi cuneatis vel acutis apice acutiusculis (saepissime fractis), costa supra plana vel prominula subtus prominente, nervis primariis ± 13 patenti-adscendentibus in venam intramarginalem crenulatam 2–4 mm. a margine confluentibus, supra leviter insculptis subtus prominulis, reticulo inconspicuo; petiolo ± 3.5 cm. longo, supra subplano; inflorescentiis terminalibus ± 6 cm. longis latisque, pedunculo 2.5 cm. longo, ramis ramulisque divaricatis; floribus non visis; fructibus irregulariter obovoideis apice paullo constrictis calycis lobis coronatis, ± 2.5 cm. longis et 1.5 cm. diametro, umbilico 5–7 mm. diametro et alto, calycis lobis 4 circiter 3–4 mm. longis.

Viti Levu: Naitasiri: Tamavua woods, alt. 150 m., *Gillespie 2269* (A, type), Aug. 15, 1927, and *Gillespie 2463* (A).

We cannot suggest any apparently close relative of this species. The fruit approaches that of *Syzygium Richii* (A. Gray) Merr. & Perry, but the dried pericarp is thinner and more easily broken. The smaller leaves in outline are somewhat like those of *S. Jambos* (L.) Alston, but the petiole is more than twice as long.

Syzygium malaccense (L.) Merr. & Perry in Jour. Arnold Arb. **19**: 215. 1938.

Eugenia malaccensis L. Sp. Pl. 470. 1753.

Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15501* (A). Vanua Levu: Thakaundrove: Vatunivuamonde Mountain, Savu Savu Bay region, alt. 0–400 m., *Degener & Ordonez 14030* (A). Kandavu: Western end of island, near Cape Washington, open woods, 0–20 m., *Smith 305* (GH).

In looking over our Polynesian material we note that, in this region as well as in the Solomon Islands, this species grows wild. Furthermore, Guillaumin (in Jour. Arnold Arb. **12**: 255. 1931) cites some sylvan New Hebrides collections under "*Eugenia* (§ *Jambosa*) *Richii* . . . var. vel spec. distincta?" These collections, as we interpret the species, belong to *S. malaccense*.

MELASTOMATACEAE

Medinilla Gaud.

Six species of *Medinilla* have been described from Fiji, but a re-examination of the genus indicates that two (*M. amoena* Seem. and *M. parvifolia* Seem.) should be combined, while three more appear to be undescribed. In view of the inadequacy of earlier descriptions, all the species are here described and a key is proposed. Important specific characters are found in the color, shape, and size of the bracts (at nodes of inflorescence) and bracteoles (at or near apex of pedicels), the size of flowers, and to a certain extent in the shape and size of leaves, their bases, venation, etc.

Three of the Fijian species have been also recorded from Samoa, namely *M. amoena, M. heterophylla,* and *M. rhodochlaena.* It seems probable that *M. amoena* does not occur in Samoa and that the specimens so reported are referable to *M. samoensis* (Hochr.) Christoph. It is quite likely that the other two species do occur in Samoa; a specimen collected by Powell (GH) may represent *M. rhodochlaena.* The remaining Fijian species, on the basis of material now available, appear to be endemic. They are not closely related to species known from the New Hebrides.

Key to the Fijian species

Floral bracteoles large, 12–35 mm. long; flowers large, the petals 13–26 mm. long, 8–25 mm. broad, the anthers 6–8 mm. long, the style 13–22 mm. long; leaves isomorphic, the blades attenuate to acute at base; montane species, local in distribution, occurring above 700 m.

Young branchlets and inflorescence-parts brown-furfuraceous or farinose; pedicel articulate 5–8 mm. below calyx, the bracteoles elliptic, 12–20 mm. long, 5–10 (–18) mm. broad, stipitate at base, soon caducous; bracts and bracteoles brown when dried. 1. *M. longicymosa.*

Young branchlets and inflorescence-parts glabrous; pedicel articulate 2–4 mm. below calyx, the bracteoles ovate, 23–35 mm. long, 15–30 mm. broad, rounded or subcordate at base, sessile, closely enveloping the flower, persistent; inflorescence-branches, bracts, and bracteoles persistently bright red ..... 2. *M. Waterhousei.*

Floral bracteoles smaller, less than 12 mm. long; flowers smaller, the petals 6–13 mm. long, 5–11 mm. broad, or less, the anthers less than 5 mm. long, the style less than 13 mm. long; leaves often dimorphic.

Bracts and bracteoles similar or dissimilar, the bracteoles elliptic or obovate to reniform, 4–14 mm. broad, often clasping and concealing the calyx, persistent and conspicuous.

Blades of larger leaves subcordate or rounded at base, rarely obtuse; dimorphism of leaves usually pronounced; bracts (at least those of distal nodes) 4–14 mm. broad, essentially similar to the bracteoles.

Inflorescence amply paniculate, with long raceme-like branches, often on stems (if associated with leaves often compactly cymose, not conspicuously divaricate); bracts usually 3 or 4 at nodes, rarely only 2, obovate, longer than broad, white; bracteoles similar to bracts, paired; anthers trilobulate at base, the posterior lobe obvious ..... 3. *M. heterophylla.*

Inflorescence divaricate-cymose; bracts paired at nodes and reniform or suborbicular (at least on distal portions of inflorescence), usually broader than long, pink; bracteoles similar to bracts; anthers bilobulate at base, the posterior lobe lacking. 4. *M. Archboldiana.*

Blades of larger leaves rounded to attenuate at base; bracts (even those of distal nodes) less than 3 mm. broad, conspicuously smaller than the bracteoles.

Flowers large, the petals 12–13 mm. long, 10–11 mm. broad, the anthers 4–5 mm. long, the posterior basal lobe larger than the two anterior lobes, the style 12–13 mm. long; bracteoles longer than broad; leaf-blades conspicuously attenuate at base, the nerves oriented from base ..... 5. *M. kandavuensis.*

Flowers smaller, the petals 7–8 mm. long, 5–7 mm. broad, the anthers 2–2.5 mm. long, the posterior basal lobe smaller than the two anterior lobes, the style about 5 mm. long; bracteoles broader than long or suborbicular; bracts and bracteoles rich pink; leaf-blades rounded to acute at base, the nerves often joined for the basal 5–15 mm. ..... 6. *M. rhodochlaena.*

Bracts and bracteoles more or less similar, obovate- or elliptic-oblong or oblong-ligulate, small, 3 mm. broad or less, the bracteoles inconspicuous, not concealing the calyx.

Leaves often dimorphic, the larger blades 5–7-nerved, 7–15 cm. long, 4.5–10 cm. broad, subcordate to broadly obtuse at base, rarely subacute ..... 7. *M. Kambikambi.*

Leaves essentially isomorphic, the blades 3–5-nerved, 2.5–9 cm. long, 1.5–5.5 cm. broad, attenuate to acute at base, rarely obtuse ..... 8. *M. amoena.*

1. **Medinilla longicymosa** Gibbs in Jour. Linn. Soc. Bot. **39:** 147. *pl. 14.* 1909; Turrill in Jour. Linn. Soc. Bot. **43:** 22. 1915.

Compact epiphytic liana, the young parts brown-furfuraceous or farinose, the branchlets subterete, cinereous, the internodes 5–15 mm. long; leaves crowded, isomorphic, the petioles slender, shallowly canaliculate, 10–25 mm. long, the blades chartaceous or subcoriaceous, brown-farinose on both surfaces, soon glabrous, brownish when dried, elliptic, 3–7.5 cm. long, 1.5–4 cm. broad, attenuate to acute at base, obtuse to rounded and often slightly retuse at apex, 3(or 5-)-nerved from base, the nerves sometimes joined for 7 mm., impressed or nearly plane above, raised beneath, the veinlets immersed; inflorescence axillary, solitary, closely brown-furfuraceous on all young parts, slenderly racemose-cymose, (3–) 5–9 cm. long, few-flowered, short-pedunculate, the branches slender, the bracts, bracteoles, and pedicels pink to crimson; bracts usually paired at nodes, papyraceous, often foliaceous, obovate, 4–10 mm. long, 2–4 mm. broad, rounded at apex, tapering to a short stipe at base; flowers 3 or 4 at distal nodes, the pedicel 13–20 mm. long, articulate and bibracteolate 5–8 mm. below calyx, gradually swollen distally; bracteoles resembling bracts but larger, elliptic, 12–20 mm. long, 5–10 (–18) mm. broad, subacute to rounded at apex, acute to obtuse or rarely subcordate at base, stipitate, the stipe 2–4 mm. long; calyx-tube subcylindric, about 5 mm. long and in diameter, gradually narrowed and stipitate at base, the limb suberect, papyraceous or membranous, 2.5–3 mm. long, entire, the teeth 4, inconspicuous; petals 4, white, waxy, membranous, often inconspicuously glandular, obovate, 13–20 mm. long, 8–12 mm. broad, rounded or slightly retuse at apex, gradually narrowed at base; stamens 8, inflexed at anthesis, the filaments ligulate, 0.8–1.2 mm. broad, 7–9 mm. long, the anthers yellow, oblong, 6–7 mm. long, trilobulate at base (anterior lobes inconspicuous, the posterior lobe larger, subglobose, 1–1.5 mm. in diameter), subacute at apex, dehiscing by a single extrorse-terminal pore; style white, 13–20 mm. long, the stigma minute.

Viti Levu: *Parks 20917* (UC); Tholo North: Nandarivatu, *im Thurn 284* (NY); Mt. Victoria, alt. 1350 m., *Gillespie 4125* (Bish, NY); Mt. Loma Langa, alt. 1200 m., *Gillespie 3777* (Bish, NY, UC) (epiphyte; native name: *wa vutu*); Namosi: Naitarandamu Mt., alt. 1150–1300 m., *Gillespie 3158* (Bish, UC), *5102* (Bish, UC). Without definite locality: *Horne 1039* (GH).

Although I have not seen the type collection (*Gibbs 884*) of this species, there seems no doubt that the cited specimens are correctly placed. Turrill states that the plant is a tall tree, 40 ft. high, but this is surely due to an error in im Thurn's field notes; all indications point to the species as a liana, which eventually may appear to be a compact epiphyte.

2. **Medinilla Waterhousei** Seem. Fl. Vit. 89. 1865; Triana in Trans. Linn. Soc. **28:** 87. 1871; Cogn. in DC. Monogr. Phan. **7:** 590. 1891; A. C. Sm. in Bishop Mus. Bull. **141:** 111. 1936.

High-climbing liana, often epiphytic, glabrous throughout, the branches slender, rooting at nodes, the branchlets subterete or quadrangular, the internodes 15–25

mm. long; leaves isomorphic, the petioles slender, shallowly canaliculate, 5–20 mm. long, the mature blades papyraceous or chartaceous, elliptic, 4–8 cm. long, 2.5–4 cm. broad, attenuate to acute at base, obtuse at apex, 3- or 5-nerved from base, the nerves sometimes joined for 5 mm., nearly plane above, raised beneath, the veinlets usually immersed; juvenile leaf-blades ovate, up to 9 cm. long and 5.5 cm. broad, conspicuously acuminate at apex (acumen to 2 cm. long); inflorescence axillary or from defoliate branchlets, drooping, few-branched, narrowly racemose-cymose, 8–25 cm. long, the branches, bracts, bracteoles, and pedicels persistently bright red, the branches slender, soft, sometimes appearing winged when dried; bracts 2 or 3 at nodes, membranaceous or papyraceous, oblong, 9–27 mm. long, 4–10 mm. broad, rounded or obtuse at base and apex, sessile; flowers 1–3 at nodes, the pedicel slender, 15–25 mm. long, articulate 2–4 mm. below calyx; bracteoles resembling bracts but larger, ovate, 23–35 mm. long, 15–30 mm. broad, obtuse or rounded at apex, rounded or subcordate and strictly sessile at base; calyx white, subcarnose, the tube cupuliform, 6–7 mm. long and in diameter, obtuse and short-stipitate at base, the limb suberect, membranous, about 3 mm. long, entire, the teeth 4, obscure; petals 4, white, membranous, obovate, 23–26 mm. long, 20–25 mm. broad, rounded at apex, obtuse at base; stamens 8, the filaments white, ligulate, 1.2–1.5 mm. broad, 8–10 mm. long, the anthers rich purple, yellow at base, oblong-subulate, 7–8 mm. long, obscurely 3-lobulate at base, subacute at apex, dehiscing by a single introrse-terminal pore; style white, 20–22 mm. long, the stigma minute; fruit subglobose, 10–12 mm. in diameter, the calyx-limb subpersistent, the pericarp thin, the seeds numerous.

Vanua Levu: Mbua: Navotuvotu, summit of Mt. Seatura, alt. 830 m., *Smith 1653* (Bish, NY) (in crest thickets; native name: *tekiteki vuina motheawa*). Taveuni: Above Somosomo, toward the lake, alt. 700–900 m., *Gillespie 4848.5* (Bish, UC) (on trunks of trees in dark mountain canyons), *Gillespie 4781* (Bish, NY, UC), *Smith 850* (Bish, GH, NY, UC, US) (in dense forest; native name: *tangimauthia*); summit of Uluingalau, alt. 1220 m., *Smith 899* (Bish, GH, NY, UC, US) (in dense forest; native name: *tangimauthia*).

The type of this striking species, *Seemann 175,* is also from Taveuni and was examined at Kew by the writer. Like *M. longicymosa,* the present species is very distinct and is apparently localized in a different series of mountains. The cited Gillespie specimens are sterile and apparently juvenile, but I have little doubt that they belong here, in spite of minor foliage differences. Notes on the color of the inflorescence parts, which are spectacularly brilliant, are incorporated in the above description.

3. **Medinilla heterophylla** A. Gray, Bot. U. S. Expl. Exped. **1:** 598. *pl. 75.* 1854; Seem. Fl. Vit. 88. 1865; Triana in Trans. Linn. Soc. **28:** 87. 1871; Cogn. in DC. Monogr. Phan. **7:** 598. 1891; Gibbs in Jour. Linn. Soc. Bot. **39:** 147. 1909.

High-climbing liana, the young parts inconspicuously brown-furfuraceous-puberulent, soon glabrescent, the branches subterete, stout, often rooting at nodes, the branchlets slender, terete; leaves conspicuously dimorphic (rarely those of a pair subsimilar); larger leaves: petioles slender, shallowly canaliculate, 12–30 mm. long, the blades chartaceous, ovate-oblong or elliptic, 6–16 cm. long, 4–10.5 cm. broad, subcordate or rounded at base, acute or short-acuminate at apex, 5- or 7-pli-nerved, the nerves often united to 12 mm. above base, slightly raised or nearly plane above, prominent beneath, the tertiaries prominulous on both surfaces or subimmersed; smaller leaves: petioles none or up to 2 mm. long, the blades suborbicular, up to 4 cm. in diameter, cordate and often subamplexicaul at base, inconspicuously 3- or 5-pli-nerved; inflorescence from main stems or terminal or axillary on branchlets, amply paniculate or cymose (when associated with leaves more compact and often only 5 cm. long), up to 50 cm. long, the branches often puberulent when young, soon glabrescent, few, raceme-like, with internodes 6–23 mm. long and swollen nodes; bracts white, (2 or) 3 or 4 in whorls at nodes,

persistent, papyraceous, obovate, 7–14 mm. long, 4–10 mm. broad, rounded at apex, obtuse at base; flowers 2–4 per node, abundant, the pedicel slender, 7–17 mm. long, with 2 apical bracteoles; bracteoles similar to bracts or suborbicular, clasping the calyx; calyx white, the tube cupuliform, 4–5 mm. long and in diameter at anthesis, obtuse or subacute at base, often minutely brownish-glandular-puberulent, the limb suberect, membranous, 1.5–2 mm. long, truncate at margin, the teeth 4, minute; petals 4, pale to rich pink, membranous, obovate, 9–10 mm. long, 8–9 mm. broad, rounded and sometimes emarginate at apex; stamens 8, the filaments slender, 4–5 mm. long at anthesis, the anthers usually yellow, oblong-subulate, about 3 mm. long, trilobulate at base (two anterior and one posterior lobes similar, rounded, about 0.5 mm. in diameter), subacute at apex, dehiscing by a single introrse-terminal pore; style 7–9 mm. long, the stigma minute; fruit globose-ovoid, purple to black, 6–8 mm. in diameter, the calyx-limb subpersistent, the pericarp thin, the seeds numerous, semi-obovoid, about 1 mm. long.

Viti Levu: Tholo North: Nauwanga, near Nandarivatu, alt. 750 m., *Degener 14358* (A), *14528* (A); Mt. Matomba, near Nandarivatu, alt. 750 m., *Degener 14641* (A); Ra: Vicinity of Rewasa, alt. 50–200 m., *Degener 15372* (A) (native name: *wa nduanilulu;* stems used for tying house frames), *15524* (A); Tholo East: Matawailevu, Wainamo Creek, alt. 500 m., *St. John 18181* (A, Bish) (native name: *mimiolo*); Serua: Vicinity of Navua, *Seemann 176* (GH); Namosi: Vicinity of Namosi, alt. 400–800 m., *Gillespie 2648* (Bish, UC), *Parks 20266* (Bish, UC); near Namuamua, alt. 350 m., *Gillespie 3038* (Bish); Naitarandamu Mt., alt. 900 m., *Gillespie 3098* (Bish); Naitasiri: Mt. Kombalevu, alt. 350–400 m., *Parks 20310* (Bish, UC); Tholo-i-suva, alt. 250 m., *Parks 20077* (Bish, UC); Tamavua-Sawani road, alt. 200 m., *Setchell & Parks 15044* (UC), *15053* (UC). Ovalau: *U. S. Expl. Exped.* (GH, NY, US, TYPE); hills above Levuka, alt. 250–600 m., *Gillespie 4532* (Bish, NY, UC). Kandavu: Mt. Mbuke Levu, alt. 200–500 m., *Smith 249* (Bish, GH, NY, UC, US). Vanua Levu: Mbua: Upper Ndama River valley, alt. 100–300 m., *Smith 1582* (Bish, GH, NY, UC, US) (native name: *kambikambi*); Seatovo Range, alt. 100–350 m., *Smith 1561* (Bish, NY) (native name: *kambikambi*); Thakaundrove: Valanga Range, alt. 200–400 m., *Smith 383* (Bish, GH, NY, UC, US) (native name: *titoko ni kalou*); near Valethi, alt. 90 m., *Degener & Ordonez 13847* (A). Taveuni: Western slope, between Somosomo and Wairiki, alt. 700–900 m., *Smith 747* (Bish, GH, NY, UC, US). Without definite locality: *Horne 191* (GH).

The abundant color notes accompanying some of the cited specimens are incorporated in the description. *Medinilla heterophylla,* occurring most often in the forests of middle elevations, is the commonest Fijian species of the genus. Its ample inflorescences, white bracts, bracteoles, and calyces, and strongly dimorphic leaves amply distinguish it. In addition to the cited specimens, I refer several others to *M. heterophylla,* although they do not represent the typical form:

(1) A form with slightly smaller and less conspicuously dimorphic leaves, inflorescences apparently restricted to the apices of branchlets, and bracts conspicuously narrower than the bracteoles is represented by the following specimens from Nandarivatu, Tholo North, Viti Levu: *Degener & Ordonez 13574* (A), *Reay 11* (A), *Gillespie 3173* (Bish, NY).

(2) A form with both bracts and bracteoles much narrower than usual is represented by a specimen from Koro: eastern slope of main ridge, alt. 300–500 m., *Smith 1013* (Bish, GH, NY, UC, US) (native name: *kambikambi*). This form appears to be transitional toward *M. Kambikambi,* which, however, has colored bracts, etc.

Neither of these forms seems worthy of nomenclatural recognition, since the species appears to be comparatively unstable; in addition it may possibly hybridize with two of its relatives, namely *M. Archboldiana* and *M. Kambikambi,* both of which are here described as new. Although the two mentioned species are probably recent derivatives from *M. heterophylla,* they appear amply distinguished on the basis of characters mentioned in the key.

4. **Medinilla Archboldiana** sp. nov.

Frutex scandens ubique inflorescentiis juvenilibus interdum brunneo-puberulis exceptis glaber, ramulis subteretibus, internodiis 3–9 cm. longis; foliis plerumque disparibus interdum similibus; foliis majoribus: petiolis gracilibus leviter canaliculatis 9–32 mm. longis, laminis chartaceis ovato-oblongis vel ellipticis, (7–) 9–16 cm. longis, (3.5–) 4.5–8 cm. latis, basi rotundatis vel subcordatis, apice obtusis vel obtuse et breviter acuminatis, 5- vel 7-pli-nerviis, nervis saepe ad 15 mm. conjunctis supra leviter impressis vel prominulis subtus prominentibus, venulis immersis vel utrinque inconspicue prominulis; foliis minoribus: petiolis 1–3 mm. longis, laminis suborbicularibus ad 3 cm. diametro, basi rotundatis vel subcordatis, 5-nerviis; inflorescentiis axillaribus vel e ramulis defoliatis orientibus, divaricato-cymosis, 5–13 cm. longis et latis, ramulis gracilibus patentibus, internodiis 12–25 mm. longis; bracteis roseis oppositis membranaceis vel papyraceis, reniformibus vel late suborbicularibus, 10–12 mm. longis, 10–14 mm. latis, valde concavis, copiose nervatis, apice rotundatis, basi rotundatis et subamplexicaulibus (inferioribus interdum oblongis et 4 × 2 mm.); floribus 2 vel 3 e nodis superioribus, pedicellis gracilibus 12–17 mm. longis; bracteolis apicalibus bracteis similibus, 6–12 mm. longis, 7–14 mm. latis; calycis tubo cupuliformi circiter 3 mm. longo et 2.5 mm. diametro, basi obtuso vel rotundato et breviter stipitato, limbo erecto-patente membranaceo circiter 1.5 mm. longo margine integro, dentibus 4 obscuris; petalis 4 membranaceis roseis obovatis circiter 7 mm. longis et latis, apice rotundatis et saepe retusis; staminibus 8, filamentis ligulatis gracilibus 2.5–3 mm. longis, antheris oblongis circiter 1.8 mm. longis, basi introrse bilobulatis (lobis obtusis circiter 0.3 mm. longis, lobo posteriore nullo), apice subacutis, poro unico introrso-terminali dehiscentibus; stylo filiformi, stigmate minuto; fructibus subglobosis 6–7 mm. diametro, calycis limbo persistente, pericarpio tenui, seminibus numerosis semi-obovoideis circiter 1 mm. longis minute papillosis.

Viti Levu: Tholo North: Vicinity of Nandarivatu, Nandrau, alt. about 600 m., *Degener 14884* (A) (in forest; native name: *wa milolo*); Nauwanga, alt. 750 m., *Degener 14366* (A, TYPE), Feb. 13, 1941 (shrubby liana, in dense forest; petals pink); Sovutawambu, alt. 750 m., *Degener 14601* (A), *14655* (A); Nandarivatu, alt. 900 m., *Gillespie 3164* (Bish) (liana, the stem 5 cm. in diameter; flowers [bracts, etc.?] crimson); 4 miles down Vunindawa trail, alt. 800 m., *Gillespie 4278* (Bish) (flowers pink).

This apparently well localized species is distinguishable from *M. heterophylla* by the characters mentioned in the key; the color and shape of the bracts may not be too stable, and it is to be hoped that future collectors will note the constancy of color in this genus. Among the cited specimens, only the type bears flowers, and the anthers of these lack the basal posterior lobe; this character may prove to be quite dependable, as no flowers of *M. heterophylla* which I have dissected lack this lobe.

5. **Medinilla kandavuensis** sp. nov.

Frutex scandens ubique partibus juvenilibus minute et decidue brunneo-furfuraceis exceptis glaber, ramulis subteretibus cinereis, internodiis 1.5–4 cm. longis; foliis subsimilibus, petiolis gracilibus leviter canaliculatis 7–25 mm. longis, laminis chartaceis vel papyraceis obovato-ellipticis, (4–) 7–12 cm. longis, (2.5–) 4–7 cm. latis, basi conspicue attenuatis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, e basi 5-nerviis, nervis adscendentibus haud conjunctis supra prominulis (vel costa leviter insculpta) subtus valde elevatis, venulis immersis; inflorescentiis axillaribus vel e ramulis defoliatis orientibus solitariis vel binis racemoso-cymosis pauciramosis 5–7 cm. longis, ramulis gracilibus; bracteis papyraceis 2–4 e nodis obovatis vel spathulato-obovatis, 5–7 mm. longis, 1.5–3 mm. latis, apice rotundatis vel obtusis, basi obtusis vel subattenuatis; floribus 2 vel 3 e nodis superioribus, pedicellis gracilibus 5–8 mm. longis; bracteolis apice pedicellorum binis membranaceis ellipticis, 9–10 mm. longis, 5–6 mm. latis, longi-

tudinaliter nervatis, apice rotundatis vel obtusis, basi gradatim angustatis et obtusis; calycis tubo cupuliformi, 6–7 mm. longo, 5–6 mm. diametro, basi obtuso et breviter stipitato, limbo suberecto membranaceo circiter 2 mm. longo margine integro, dentibus 4 minutis; petalis 4 pallide roseis membranaceis obovatis, 12–13 mm. longis, 10–11 mm. latis, apice rotundatis vel retusis interdum minute mucronulatis; staminibus 8, filamentis albis membranaceis ligulatis 4–5 mm. longis, antheris oblongis 4–5 mm. longis, basi trilobulatis (lobis 2 interioribus circiter 0.5 mm. diametro, lobo posteriore paullo majore), apice gradatim angustatis et obtusis poro unico terminali dehiscentibus; stylo albo filiformi 12–13 mm. longo, stigmate minuto.

KANDAVU: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 201* (Bish, GH, TYPE, NY, UC, US), Oct. 18, 1933 (liana, in forest; petals pale pink; filaments and style white; anther-lobes yellow).

The new species shows points of similarity with both *M. rhodochlaena* and *M. amoena,* but it seems to be amply characterized by its large flowers, leaf-shape, proportions of bracts and bracteoles, etc. Unfortunately I neglected to note the color of the bracts, bracteoles, and calyx, but from the appearance of the dried specimens I judge that these parts were pale pink.

6. **Medinilla rhodochlaena** A. Gray, Bot. U. S. Expl. Exped. **1:** 600. 1854; Triana in Trans. Linn. Soc. **28:** 88. 1871; Cogn. in DC. Monogr. Phan. **7:** 602. 1891; Gibbs in Jour. Linn. Soc. Bot. **39:** 147. 1909; Turrill in Jour. Linn. Soc. Bot. **43:** 22. 1915.

Liana or subscandent shrub, the young parts brown-furfuraceous, often glabrescent, the branchlets slender, the internodes 1–5 cm. long; leaves dimorphic or isomorphic; larger leaves: petioles slender, shallowly canaliculate, often brown-puberulent, 8–20 mm. long, the blades chartaceous or subcoriaceous, often subpersistently brown-furfuraceous beneath, elliptic-oblong, 6–15 cm. long, (2–) 3.5–7 cm. broad, acute to rounded at base, obtusely acuminate at apex, (3- or) 5-pli-nerved, the inner nerves joined for 5–15 mm., impressed above, prominent beneath, the veinlets immersed or prominulous beneath; smaller leaves: petioles 1–4 mm. long, the blades oblong, to 4 cm. long and 2 cm. broad or smaller, rounded at base, obtuse at apex, 3–5-nerved; inflorescence axillary, solitary, cymose-racemose (often reduced to a single whorl of flowers on a short peduncle), 1–5 cm. long, the branches slender, brown-furfuraceous, often glabrescent; bracts (2 or) 3 or 4, whorled at nodes, rich pink, papyraceous, brown-furfuraceous, glabrescent, oblong, (1.5–) 2–5 mm. long, 1–3 mm. broad, obtuse at base and apex; flowers 3 or 4 per node, the pedicel slender, often furfuraceous, 2–8 mm. long; bracteoles paired, apical, clasping the calyx, rich pink, papyraceous or submembranous, orbicular or reniform, 4–10 mm. long, 5–11 mm. broad, rounded at base and apex, broad at base; calyx rich pink, the tube cupuliform, about 2 mm. long and 3.5 mm. in diameter, rounded at base, often puberulent, the limb suberect, membranous, about 1.5 mm. long, entire, the teeth 4, minute; petals 4, pink to pale purple, membranous, oblong-obovate, 7–8 mm. long, 5–7 mm. broad, rounded or subretuse at apex; stamens 8, the filaments slender, ligulate, about 3 mm. long, the anthers oblong, 2–2.5 mm. long, trilobulate at base (two anterior lobes about 0.5 mm. in diameter, the posterior lobe calcarate, slightly smaller), obtuse at apex, dehiscing by two often confluent terminal pores; style about 5 mm. long, the stigma minute; fruit subglobose, black at maturity, 6–7 mm. in diameter, the calyx-limb persistent, the pericarp thin, the seeds numerous, semi-obovoid, 1–1.2 mm. long, minutely papillose.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, alt. 900 m., *Gillespie 4277* (Bish); Rewa: Vicinity of Suva, *Meebold 8174* (Bish); Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13748* (A) (in forest); Tamavua woods, alt. 150 m., *Gillespie 2088* (Bish); Nasinu, alt. 150 m., *Gillespie 3600* (Bish, NY, UC); Central Road, alt. 230 m., *MacDaniels 1154* (Bish); Naikorokoro, *Meebold 21945* (Bish). OVALAU: *U.*

S. Expl. Exped. (GH, US, TYPE), *Seemann 177* (GH); upper ridge, alt. 250 m., *Bryan 598* (Bish). WITHOUT DEFINITE LOCALITY: *Horne 687* (GH).

Medinilla rhodochlaena is readily distinguished by its comparatively narrow and thick leaves, short and richly colored inflorescences, dissimilar bracts and bracteoles, etc. Seemann reports the native name *thavathava resinga*. Color notes accompanying the cited specimens are incorporated in the description.

7. **Medinilla Kambikambi** sp. nov.

Frutex scandens ubique glaber vel partibus novellis inconspicue brunneo-farinosis, ramulis teretibus cinereis, internodiis 2.5–5 cm. longis; foliis saepe disparibus interdum subsimilibus; foliis majoribus: petiolis plerumque gracilibus leviter canaliculatis 15–50 mm. longis, laminis chartaceis ovato-oblongis, 7–15 cm. longis, 4.5–10 cm. latis, basi subcordatis vel obtusis raro subacutis, apice obtuse cuspidatis vel obtusis, 5- vel 7-pli-nerviis, nervis ad 20 mm. interdum conjunctis supra prominulis vel subplanis subtus elevatis vel leviter prominulis, venulis immersis vel paullo prominulis; foliis minoribus: petiolis 2–3 mm. longis, laminis suborbicularibus ad 4.5 cm. diametro, basi et apice rotundatis, 5-pli-nerviis; inflorescentiis axillaribus et solitariis vel e ramulis defoliatis orientibus et saepe 2 vel 3 aggregatis, cymosis, 5–9 cm. longis, pedunculo ad 4 cm. longo, ramulis gracilibus interdum cum partibus juvenilibus minute brunneo-furfuraceis; bracteis 2–4 e nodis roseis membranaceis obovato-oblongis, 3–8 mm. longis, 1–3 mm. latis, apice obtusis, basi obtusis vel gradatim angustatis; floribus 2–4 e nodis, pedicellis gracilibus interdum ad 3 mm. infra calycem articulatis sub anthesi 4–7 mm. longis; bracteolis ut bracteis vel paullo minoribus; calyce roseo, tubo cupuliformi, 2–5 mm. longo, 3–5 mm. diametro, basi rotundato vel obtuso, interdum minute puberulo, limbo suberecto membranaceo 1–2 mm. longo integro, dentibus 4 minutis; petalis 4 roseis membranaceis late obovatis, 5–10 mm. longis et latis, apice rotundatis vel subretusis; staminibus 8, filamentis ligulatis 1.5–3 mm. longis, antheris luteis oblongis 1.5–3.5 mm. longis, basi trilobulatis (lobis subaequalibus circiter 0.5 mm. diametro), apice obtusis poro unico subterminali dehiscentibus; stylo filiformi 4–5 mm. longo, stigmate minuto.

VANUA LEVU: Mbua: Lower Wainunu River valley, alt. 0–200 m., *Smith 1747* (Bish, GH, NY, UC, US); Thakaundrove: Yanawai River region, Mt. Kasi, alt. 300–430 m., *Smith 1782* (Bish, NY); southern slope of Korotini Range, alt. 300—650 m., *Smith 503* (Bish, GH, NY, UC, US); Mt. Mariko, southern slope, alt. 300–600 m., *Smith 404* (Bish, GH, NY, UC, US); Natewa Peninsula, hills south of Natewa, alt. 400–600 m., *Smith 1959* (Bish, GH, NY, TYPE, UC, US), June 12, 1934.

The cited specimens were all collected in fairly dense foothill forest and the native name *kambikambi* was applied to all of them. While this is often used as a more or less generic term for the lowland species of *Medinilla* in Fiji, it is perhaps more strictly referred to the forms with colored bracts, at least on Vanua Levu. Color notes are incorporated in the description. While *M. Kambikambi* shows a similarity to *M. amoena* in its reduced bracts and bracteoles, foliage differences seem to differentiate it.

8. **Medinilla amoena** Seem. Fl. Vit. 88. 1865; Triana in Trans. Linn. Soc. **28**: 87. 1871; Cogn. in DC. Monogr. Phan. **7**: 590. 1891.

Medinilla parvifolia Seem. Fl. Vit. 89. 1865; Triana in Trans. Linn. Soc. **28**: 89, as *M. parviflora*. 1871; Cogn. in DC. Monogr. Phan. **7**: 603, as *M. parviflora*. 1891; Gillespie in Bishop Mus. Bull. **83**: *26. f. 33.* 1931.

Liana or shrub, probably subscandent, the stem often appressed to tree-trunks, the young parts brown-furfuraceous, glabrescent, the branchlets terete, the internodes 8–30 mm. long; leaves essentially isomorphic, the petioles slender, shallowly canaliculate, 5–25 mm. long, the blades chartaceous, glabrous (or sparsely

brown-furfuraceous when young), elliptic, 2.5–9 cm. long, 1.5–5.5 cm. broad, attenuate to acute at base (rarely obtuse), obtusely cuspidate at apex, 3- or 5-plinerved, the nerves often joined slightly above base, prominulous or plane above, prominent or sharply elevated beneath, the veinlets immersed; inflorescences axillary, usually solitary, racemose- or paniculate-cymose, 2–7 cm. long, the branches slender, brown-puberulent or stellate-furfuraceous, glabrescent, often reddish; bracts (2–) 4, whorled at nodes, submembranous or papyraceous, oblong-ligulate, usually 2–4 mm. long and 0.7–1.5 mm. broad (the lower ones sometimes to 10 mm. long and 3 mm. broad), obtuse at apex, obtuse or gradually narrowed to a short stipe at base; flowers 2 or 3 per node, the pedicel slender, puberulent or furfuraceous, glabrescent, often reddish, 2.5–5 (–15 in fruit) mm. long; bracteoles paired (pedicellary articulation sometimes to 2 mm. below calyx), similar to bracts, elliptic-oblong or oblong-obovate, at length caducous; calyx-tube cupuliform, 2.5–4 mm. long and in diameter at anthesis, obtuse at base and sometimes abruptly narrowed to a short stipe, often puberulent, the limb suberect, membranous, 1–1.5 mm. long, entire, the teeth 4, minute; petals 4, pink to purple, membranous, obovate-oblong to obovate-spatulate, (3–) 6–7.5 mm. long and broad, obtuse or rounded at apex; stamens 8, the filaments slender, ligulate, 1.5–3.5 mm. long, the anthers yellow, oblong-subulate, 1.5–2 mm. long, trilobulate at base (two anterior lobes about 0.5 mm. in diameter, the posterior lobe slightly larger), obtuse at apex, dehiscing by a single terminal pore; style filiform, to 6 mm. long, the stigma minute; fruit subglobose, black at maturity, 6–7 mm. in diameter, the calyx-limb persistent, the pericarp thin, the seeds numerous, semi-obovoid, 1–1.2 mm. long, minutely papillose.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 800–900 m., *Degener & Ordonez 13571* (A), *Gillespie 4183* (Bish), *4234* (Bish, NY); Nandrau, near Nandarivatu, alt. about 600 m., *Degener 14883* (A) (native name: *lewandomondomo*); Mt. Matomba, near Nandarivatu, alt. 790 m., *Degener 14461* (A) (native name: *mathou*); Namosi: Vicinity of Namosi, alt. about 450 m., *Gillespie 2875* (Bish, UC) (native name: *mimiloro*), *Seemann 182* (GH, TYPE COLL.); slopes of Mt. Voma, alt. 550 m., *Gillespie 2895* (Bish, NY, UC); Serua: Ngaloa, alt. near sea-level, *Degener & Ordonez 13616* (A). Ovalau: Hills above Levuka, alt. 300–350 m., *Gillespie 4486* (Bish), *4551* (Bish, NY, UC). Vanua Levu: Mbua: Navotuvotu, summit of Mt. Seatura, alt. 830 m., *Smith 1666* (Bish, GH, NY, UC, US), *1671* (Bish, NY, US); Thakaundrove: Uluinabathi Mt., Savu Savu Bay region, alt. 150 m., *Degener & Ordonez 13939* (A).

The cited specimens were collected in forest or in upland thickets; the color of bracts and bracteoles has not been noted but apparently they are pale pink. While I have not directly compared the type of *M. parvifolia* with most of the above-cited specimens, I examined it at Kew in 1935 and concluded that it was identical with *Smith 1666*, a specimen with unusually small leaves and with bracts and bracteoles larger than average. This plant was growing in an exposed position in crest-thickets, and it may be assumed that *Seemann 178*, the type of *M. parvifolia*, collected on the summit of Mt. Voma in Namosi Province, was taken from a similarly exposed plant. In view of the gradations present in the specimens now available, I do not believe that Seemann's two species can be maintained. The four Gillespie specimens, upon which his redescription of *M. parvifolia* was based, are precisely similar to the type collection of *M. amoena*.

Clidemia D. Don

Clidemia has apparently not been previously reported from the Pacific in strictly botanical literature, a rather surprising fact, since one species has become the most pernicious weed in Fiji and is to be looked for in other groups.

Clidemia hirta (L.) D. Don in Mem. Wern. Soc. **4**: 309. 1823; in DC. Prodr. **3**: 157. 1828; Cogn. in DC. Monogr. Phan. **7**: 986. 1891.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 750 m., *Degener 14266* (A) (naturalized shrub to 2 m. high, in open forest; petals white); Rewa: Suva Bay, near sea-level, *Bryan 187* (A, Bish) (low shrub along roadsides; petals white; fruit purple; local name: *Koster's curse*); Naitasiri: Tamavua, *Gillespie 2015* (Bish, NY). Kandavu: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 119* (Bish, GH, NY) (low shrub, to 1 m. high, on edge of forest; petals white to pink). Vanua Levu: Mbua: Southern portion of Seatovo Range, alt. 100–350 m., *Smith 1703* (Bish, NY) (shrub 1–3 m. high, forming dense thickets in dry forest; petals white; fruit deep purple; a common pernicious weed; native name: *kaurasinga*).

This extremely abundant shrub often forms impenetrable masses in dryish forest, spreading with great rapidity in areas which are subject to the depredations of wild cattle. Its control, and if possible its eradication, are major problems for agriculturists in Fiji. Discussions of the species in Fiji have appeared in agricultural journals, the record being given here merely to introduce the name into the more specialized literature.

Astronidium A. Gray

In proposing the genus *Astronidium* for a single Fijian species, Gray (in Proc. Am. Acad. **3**: 53. 1853; Bot. U. S. Expl. Exped. **1**: 581. 1854) differentiated it from *Astronia* Bl. on the basis of its tetramerous flowers, calcarate anthers, and minute stigma. The genus was maintained by Seemann, who added a second species, but the monographers of the family, Triana and Cogniaux, submerged it in *Astronia*. Markgraf (in Notizbl. Bot. Gart. Berlin **12**: 47–50. 1934) pointed out that the genus should be maintained, on the basis of much stronger characters than those mentioned by Gray, and enlarged to include all the Polynesian species, some of the Papuasian ones, and one species from Borneo. Some recent students including Christophersen (in Bishop Mus. Bull. **154**: 31–34. 1938) have accepted this separation, and on re-examination of the group the present writer finds that the two genera are sharply distinct.

The species of *Astronia*, as first pointed out by Merrill (in Philip. Jour. Sci. Bot. **8**: 337. 1913), are polygamo-dioecious (very frequently if not always), while *Astronidium* always has perfect flowers. The calyx-lobes of *Astronia* are isomerous and apparent in the bud, while the calyces of *Astronidium* remain closed much later and then usually rupture irregularly. Staminal differences between the two genera are pronounced. A difference which I have not seen elsewhere emphasized and which is very constant is to be found in the ovulation. The ovary-cells of *Astronia* are 2 (in all the specimens which I have examined, although 4 are mentioned in some descriptions) and the placentas are flat or pulvinate, with erect seeds. In *Astronidium* the ovary-cells are 4 to several (rarely 2 or 3), and the placentas are erect and clavate, with radiating seeds. The placental character is especially obvious in fruits after the wall has split and the seeds fallen. Differences between the two genera are thus expressed in a key:

Plants polygamo-dioecious, some with perfect and others with staminate flowers; calyx-lobes apparent in bud, marked by radiating lines on the summit, the limb usually isomerously dentate; anthers about as broad as long, the connective conspicuously enlarged dorsally, the locules short, the basal spur none; ovary 2(–4?)-celled, the placentas inconspicuous, flattened or pulvinate, the seeds erect ..... *Astronia Bl.*

Plants always with perfect flowers; calyx-bud closed, without indication of lobes, at length irregularly (or usually so) rupturing; anthers much longer than broad, the connective not dorsally enlarged, the locules elongate, occupying the entire long inner face of the

connective, the basal spur straight, slender, rarely lacking (always present in Fijian species); ovary 4–several-celled (rarely 2- or 3-celled), the placentas conspicuous, erect, clavate, the seeds divergent ..... *Astronidium* A. Gray.

Many Pacific species originally described in *Astronia* have already been transferred to *Astronidium*. However, the following combinations, based on the only two species of the group thus far described from the New Hebrides, are necessary: **Astronidium aneityense** (Guillaumin) comb. nov. (*Astronia aneityensis* Guillaumin in Jour. Arnold Arb. **12**: 261. 1931); **Astronidium banksianum** (Guillaumin) comb. nov. (*Astronia banksiana* Guillaumin in Jour. Arnold Arb. **12**: 261. 1931). Neither of these species has very close relatives among the Fijian species of *Astronidium*.

I am able to distinguish 12 species of the genus in Fiji. *Astronia fraterna* A. Gray was reported from Fiji by Seemann (Fl. Vit. 85. 1865) on the basis of a sterile branch collected by Milne on Viti Levu. One may be sure that this is a misidentification. The type of *Astronia fraterna*, from the Societies, is most similar, among Fijian species, to *Astronidium parviflorum*, but it has 5-merous flowers, a larger calyx-limb, a more compact inflorescence, and smaller leaves.

Two Fijian species have been reported from Samoa, one of them being *Astronidium parviflorum*, Samoan records of which I have not personally verified. *Astronia confertiflora* was reported from Samoa by Reinecke, but Christophersen (in Bishop Mus. Bull. **154**: 34. 1938) expresses doubt of the determination. As to the only other species believed to occur in both Samoa and Fiji, *Astronidium Pickeringii* A. Gray (with two varieties), I have concluded that Gray's concept includes two species; these are discussed below under *Astronidium victoriae*.

Key to the Fijian species

Leaf-blades glabrous beneath (sometimes brown-furfuraceous on nerves and sparsely so on surface, but not persistently so).

Flowers comparatively small, the calyx 2–6 mm. long and in diameter at anthesis, the lobes inconspicuous, less than 1 mm. long, the petals 4–6, less than 7 mm. long and 4 mm. broad, the anthers 2–5 mm. long; mature fruit 3–8 mm. in diameter.

Pedicels less than 1 mm. long, the flowers and fruits essentially sessile; tomentum or puberulence of inflorescence-branches and calyx often persistent in fruiting specimens ..... 1. *A. confertiflorum.*

Pedicels at least 1.5 mm. long, obvious.

Calyx splitting into 4–6 lobes (these rarely to 8 in fruiting calyces).

Leaf-blades more than twice as long as broad; petals 4, small, 2.5–3 mm. long; calyx at anthesis 2–3 mm. long; anthers 2–2.5 mm. long ..... 2. *A. parviflorum.*

Leaf-blades less than twice as long as broad; petals 5 or 6, larger, 5–7 mm. long; calyx at anthesis 4–4.5 mm. long; anthers 3.5–4.5 mm. long .. 3. *A. floribundum.*

Calyx splitting into 8–11 lobes or more or essentially truncate.

Leaf-blades elliptic or oblong or ovate, the outer collecting nerves usually more than 1 mm. from margin; calyx about as broad as long, minutely furfuraceous-lepidote when young, often persistently so, the limb erect and with small but obvious lobes; anthers 3.5 mm. long or less ..... 4. *A. victoriae.*

Leaf-blades elliptic to obovate, the outer collecting nerves less than 1 mm. from margin; calyx broader than long, glabrous, the limb incurved and essentially truncate at apex; anthers 4–5 mm. long ..... 5. *A. inflatum.*

Flowers comparatively large, the calyx 7–12 mm. long and in diameter at anthesis, the lobes large, 1–5 mm. long, the petals 6–10, large, 7–12 mm. long, 3–7 mm. broad, the anthers 5–9 mm. long; mature fruit 10–15 mm. in diameter.

Leaf-blades large, 11–27 cm. long, 5–17 cm. broad, 5-nerved, the 4th and 5th nerves 2–7 mm. within margin, paralleled by a fainter collecting-nerve.

Leaves petiolate, the 3 principal nerves joined less than 2.5 cm. above base, the petioles 1.2–6 cm. long ..... 6. *A. robustum.*

Leaves sessile, the 3 principal nerves joined 3–4 cm. above base .....7. *A. sessile.*
Leaf-blades smaller, 7–14 cm. long, 3–6.5 cm. broad, 3-nerved, the 4th and 5th nerves inconspicuous, 1 mm. or less from margin.
Inflorescence compact, few-flowered, not more than 9 cm. broad even in fruit; pedicels 3–8 mm. long; petals about 12 mm. long and 7 mm. broad; anthers about 7 mm. long .....8. *A. macranthum.*
Inflorescence ample, many-flowered, 9–17 cm. broad; pedicels 1 mm. long or less; petals 7–8 mm. long, 3–4 mm. broad; anthers 5–5.5 mm. long .....9. *A. Degeneri.*
Leaf-blades densely and persistently brown-pubescent beneath.
Leaves small, the blades 5–9 cm. long, 2–4.5 cm. broad, the lower surfaces, inflorescence-branches, calyces, etc., completely obscured by a layer of minute ciliolate or substellate scales less than 0.1 mm. in diameter .....10. *A. tomentosum.*
Leaves larger, the blades 10–22 cm. long, 4–12 cm. broad, the lower surfaces, inflorescence-branches, calyces, etc., less closely pubescent than the preceding, the hairs simple, spreading.
Inflorescences, leaf-blades beneath, etc., subhispid with subulate hairs 1–2.5 mm. long. 11. *A. Storckii.*
Inflorescences, leaf-blades beneath, etc., tomentellous or puberulent with often clavate hairs 0.2–0.5 mm. long .....12. *A. kasiense.*

1. **Astronidium confertiflorum** (A. Gray) Markgraf in Notizbl. Bot. Gart. Berlin **12**: 49. 1934.

Astronia confertiflora A. Gray, Bot. U. S. Expl. Exped. **1**: 579. 1854; Seem. Fl. Vit. 86. 1865; Triana in Trans. Linn. Soc. **28**: 152, as *A. consertiflora.* 1871; Cogn. in DC. Monogr. Phan. **7**: 1097. 1891.

Tree or shrub to 10 m. high, the young parts usually densely brown-furfuraceous-puberulent, at length glabrescent, the branchlets subterete or distally quadrangular; petioles slender, canaliculate, 2–5 (–7) cm. long; leaf-blades papyraceous to subcoriaceous, elliptic, 9–18 cm. long, 3–10 cm. broad, obtuse to obscurely subcordate at base, gradually narrowed to an acute or cuspidate apex, slightly recurved at margin, the principal nerves 3 or 5, sometimes united for 1 cm., impressed or nearly plane above, prominent and often conspicuously puberulent beneath, the marginal collecting nerves inconspicuous, the cross-veins faintly impressed or plane above and prominulous beneath; inflorescence terminal, trichotomously cymose, many-flowered, often persistently furfuraceous-puberulent, 5–9 cm. long, 8–15 cm. broad, the branchlets often flattened, the bracts subfoliaceous, about 7 by 3 mm. or larger, caducous, the bracteoles similar or linear, 4–5 mm. long, acute; flowers crowded at ends of ultimate branchlets, the pedicels 1 mm. long or less; calyx coriaceous, obscurely furfuraceous-peltate with minute scales, glabrescent, cupuliform, about 4 mm. long and 3.5 mm. in diameter, the limb erect and about 1.5 mm. long at anthesis, irregularly splitting into 8–10 oblong obtuse lobes 0.7–1 mm. long and 0.7–1.5 mm. broad; petals 4 or 5, oblong, about 3.5 mm. long, 2–2.5 mm. broad, rounded at apex; stamens 8 or 10, the filaments carnose, ligulate, about 2.5 mm. long, the anthers oblong, about 2.5 mm. long, recurved at apex, the basal spur acute, about 0.7 mm. long; style carnose, about as long as petals; locules 4 or 5; fruit depressed-globose, 3.5–6 mm. in diameter, often puberulent, the calyx-limb with 8–16 lobes, the mature placentas usually 5, rarely 4, clavate, 1–2 mm. long, retuse or truncate at apex, the seeds obovoid, 0.7–1 mm. long.

Viti Levu: Rewa: Near Suva, alt. about 200 m., *Bryan 365* (Bish) (tree 4–5 m. high, in rain-forest near stream, the bark gray-brown, nearly smooth); Naitasiri: Central Road, alt. 230 m., *MacDaniels 1139* (Bish) (tree 10 m. high, in rain-forest); Mt. Korombamba, alt. 500–600 m., *Gillespie 2348* (Bish, UC) (woods near summit), *Gillespie 2389* (Bish, UC) (summit), *Parks 20338* (Bish, UC) (tree 4 m. high, on cliff near summit). Vanua Levu: Mbua: Mbua Bay region, *U. S. Expl. Exped.* (GH, US, TYPE); upper Ndama River valley, alt. 100–300 m., *Smith 1600* (Bish, GH, NY, UC, US) (shrub 4 m. high, in dense forest; native name: *ndava*). Taveuni: Mountain slopes above Somosomo, alt. 650 m., *Gillespie 4833* (Bish, NY, UC) (common small tree).

The first five species of my key are closely related and not always easy to distinguish, but *A. confertiflorum* is quite distinct on the basis of its subsessile flowers and fruits. Presence of tomentum on the inflorescence-branches or its persistence is not an entirely dependable character in this group of species, but in *A. confertiflorum* it seems more persistent than in its relatives.

2. **Astronidium parviflorum** A. Gray in Proc. Am. Acad. **3:** 53. 1853; Bot. U. S. Expl. Exped. **1:** 582. *pl. 72C.* 1854; Seem. Fl. Vit. 87. 1865; Markgraf in Notizbl. Bot. Gart. Berlin **12:** 49. 1934.

Astronia parviflora Triana in Trans. Linn. Soc. **28:** 152. 1871; Cogn. in DC. Monogr. Phan. **7:** 1099. 1891.

Small tree, up to 7 m. high, the young parts glabrous or occasionally brown-furfuraceous-puberulent and soon glabrescent, the branchlets subterete or distally quadrangular; petioles slender, 13–40 mm. long; leaf-blades chartaceous, elliptic, 6–18 cm. long, 2.5–8 cm. broad, obtuse to subattenuate at base, obtuse or acute at apex, slightly recurved at margin, the principal nerves 3, sometimes united for 1 cm., lightly impressed above and subprominent beneath, the marginal collecting-nerve inconspicuous, prominulous beneath, the cross-veins plane above and prominulous beneath; inflorescence terminal, trichotomously cymose, usually glabrous, 6–12 cm. long, 7–15 cm. broad, the branchlets somewhat flattened, the bracts elliptic, short-stipitate, 7–9 mm. long, soon deciduous, the bracteoles caducous; flowers usually in threes at apices of ultimate branchlets, the pedicels slender, 1.5–4 mm. long; calyx lepidote with scattered minute reddish peltate scales, glabrescent, cupuliform, 2–3 mm. long and in diameter, the limb erect, 0.7–1.5 mm. long, splitting into 4 or 5 (rarely 8) lobes, the lobes broadly ovate, 0.3–1 mm. long, 1–2 mm. broad, obtuse or apiculate at apex; petals 4, submembranous, oblong, 2.5–3 mm. long, 1.5–2 mm. broad, obtuse or subacute at apex; stamens 8 (rarely 6), the filaments thin-carnose, ligulate, 1.5–2.5 mm. long, the anthers oblong, 2–2.5 mm. long, recurved or obtuse at apex, the basal spur acute, 0.5–1 mm. long; style 2–3.5 mm. long, the locules usually 4 (rarely 2 or 3); fruit depressed-subglobose, 3–5 mm. in diameter, the mature placentas usually 4 (rarely 2 or 3), clavate, 1–1.5 mm. long, flattened or slightly retuse at apex, the seeds obovoid or dolabriform, 0.8–1.2 mm. long.

Viti Levu: Namosi: Voma Mt., *Seemann 173* (GH); Vakarongasiu Mt., alt. 900 m., *Gillespie 3257* (Bish); Naitarandamu Mt., alt. 1100–1250 m., *Gillespie 3240* (Bish, NY, UC), *3347* (Bish, NY, UC), *3373* (Bish, UC). Ovalau (or Mbau?): *U. S. Expl. Exped.* (GH, NY, US, type). Vanua Levu: Thakaundrove: Mt. Uluingala, Natewa Peninsula, alt. 600–820 m., *Smith 1987* (Bish, GH, NY, UC, US) (shrub 4 m. high, in dense forest). Taveuni: Western slope, between Wairiki and Somosomo, alt. 400 m., *Smith 725* (Bish, GH, NY, UC, US) (shrub 5 m. high, in forest; petals, stamens, and style white; native name: *mothe lutu*). Without definite locality: *Horne 1038* (GH).

Astronidium parviflorum, the genotype, is readily enough distinguished by its small 4-merous flowers; this and the next are the only species of the genus in which I have noted fewer than 4 ovary-cells. When flowers are lacking, *A. parviflorum* is difficult to distinguish from its allies. However, it may be distinguished from *A. floribundum* by its leaf-shape and from *A. victoriae* by the fewer lobes of its usually smaller calyx in fruit.

3. **Astronidium floribundum** (Gillespie) comb. nov.

Astronia floribunda Gillespie in Bishop Mus. Bull. **83:** 24. *f. 30.* 1931.

Viti Levu: Naitasiri: Southeastern slopes of Korombamba Mt., alt. 400 m., *Gillespie 2246* (Bish, type, GH, UC).

The original description, based on the only known collection of the species, is adequate. The relationship of *A. floribundum* to *A. parviflorum* is indicated by the lepidote calyx with comparatively few lobes. The two species are amply

distinguished by floral and foliage characters. Gillespie reports the type-locality as being in the province of Rewa, but Korombamba Mt. is on the boundary of that province and Naitasiri, and the southeastern slopes presumably lie in Naitasiri. I note that the petals are often 6 and somewhat larger than the original description implies, being up to 7 by 4 mm.; the stamens are 10 or 12, the anthers up to 4.5 mm. long; the ovary-cells appear to be usually 3 as noted by Gillespie but some variation is to be anticipated in this character.

4. **Astronidium victoriae** (Gillespie) comb. nov.

Astronia Pickeringii A. Gray, Bot. U. S. Expl. Exped. **1**: 577, in part. 1854; Triana in Trans. Linn. Soc. **28**: 152. 1871.

Astronia Pickeringii var. *vitiensis* A. Gray, Bot. U. S. Expl. Exped. **1**: 578. *pl. 72B* (excl. *f. 1–8*). 1854; Seem. Fl. Vit. 86. 1865; Cogn. in DC. Monogr. Phan. **7**: 1095. 1891.

Astronia victoriae Gillespie in Bishop Mus. Bull. **83**: *25. f. 32.* 1931.

Tree or shrub 3–7 m. high, the young parts brown-furfuraceous-puberulent, glabrescent, the branchlets subterete or distally quadrangular; petioles slender, canaliculate, 1–4.5 (–6.5) cm. long; leaf-blades thin-coriaceous or chartaceous, elliptic or oblong or ovate, 6–14 (–17) cm. long, 2–7.5 (–10) cm. broad, rounded or obtuse at base, obtuse at apex, slightly recurved at margin, the principal nerves 3, from base or joined up to 5 mm., impressed above, prominent beneath, the marginal collecting-nerves 2 (sometimes faintly 4), the cross-veins slightly impressed or plane above, prominulous beneath; inflorescence terminal, trichotomously cymose, sometimes puberulent and soon glabrescent, 5–15 cm. long, 8–17 cm. broad, the branchlets slightly flattened, the bracts foliaceous, about 15 by 3 mm. or larger, the bracteoles linear, about 5 mm. long, soon deciduous; flowers usually in threes, the pedicels 2–5 mm. long; calyx coriaceous, minutely ferruginous-furfuraceous-lepidote, glabrescent, cupuliform, 4–6 mm. long and in diameter, the limb erect, about 2 mm. long, irregularly splitting into 8–11 lobes, the lobes subdeltoid, 0.3–1 mm. long, 0.5–2 mm. broad, obtuse at apex; petals 5 or 6, submembranous to thin-carnose, oblong or broadly obovate, at anthesis 4–5 mm. long and 3–3.5 mm. broad, rounded at apex; stamens 10 or 12, the filaments carnose, ligulate, at anthesis 3–4 mm. long, the anthers oblong, 3–3.5 mm. long, obtuse or conspicuously recurved at apex, the basal spur acute, 0.5–1 mm. long; style carnose, about as long as petals, the locules 5 or 6 (rarely 7); fruit depressed-subglobose, usually glabrescent, 4–8 mm. in diameter, the calyx-lobes sometimes up to 20, the mature placentas 5 or 6 (rarely 7), clavate, 2–3 mm. long, retuse at apex, the seeds oblong-clavate, 0.8–1.5 mm. long.

Viti Levu: Tholo North: Mt. Victoria, near summit, alt. 1200 m., *Gillespie 4101* (Bish, type, GH, UC); Loma Langa Mt., near summit, alt. 1200 m., *Gillespie 3936* (UC); vicinity of Nandarivatu, alt. 750–830 m., *Degener 14798* (A) (tree 3 m. high, in open forest), *Greenwood 849* (A) (tree about 6 m. high; flowers white); vicinity of Nasukamai, alt. 480 m., *Gillespie 4396.1* (Bish, UC) (native name: *tava*); Tholo East: South of Matawailevu, alt. about 500 m., *St. John 18230* (A, Bish) (tree 10 m. high, on steep bank overhanging river; native name: *ndiriniu*); Namosi: Southeast of Namosi, alt. 500 m., *Gillespie 2870* (Bish); Voma Mt., alt. 500 m., *Gillespie 2495* (Bish, GH, UC) (native name: *tava*); Naitasiri: Upper Waindina River, alt. 50 m., *MacDaniels 1025* (Bish) (tree 10 m. high; native name: *tavo*). Ovalau: Alt. 300 m., *U. S. Expl. Exped.* (GH, US, type of *Astronia Pickeringii* var. *vitiensis*). Vanua Levu: Mbua: Upper Ndama River valley, alt. 100–300 m., *Smith 1586* (Bish, GH, NY, UC, US) (tree 5 m. high; native name: *wai susu*). Taveuni: Vicinity of Waiyevo, alt. 600 m., *Gillespie 4726* (Bish, NY, UC) (in woods); mountain ridges above Somosomo, alt. 800 m., *Gillespie 4777* (Bish) (common small tree). Moala: *Bryan 314* (Bish) (tree 5–6 m. high, in rain-forest on ridge-slopes, alt. about 200 m.); Ndelaimoala, alt. 400 m., *Smith 1363* (Bish, GH, NY, UC, US) (shrub 3 m. high, at edge of forest).

Gray based his *Astronia Pickeringii* upon two varieties, *samoensis* and *vitiensis*. In examining type material and a series of specimens referable to the variety *vitiensis*, I have come to the conclusion that the differences are of a specific nature. The only Samoan material of this complex available to me is the type collection, which bears immature flowers. Therefore a discussion of flowering and fruiting differences, if any exist, cannot be given at present. A very obvious foliage difference, concerning the crystal-bearing cells, serves to separate the two forms readily, as follows:

Upper surface of leaf-blades smooth, with numerous conspicuous crystal-bearing cells 0.2–0.3 mm. long lying just beneath the epidermis; leaf-blades acute to subattenuate at base, brownish green when dried .....*Astronidium Pickeringii* (A. Gray) Christoph. (*Astronia Pickeringii* var. *samoensis* A. Gray).

Upper surface of leaf-blades papillose, the crystal-bearing cells obscure, scarcely visible under magnification; leaf-blades obtuse or rounded at base, often yellowish green when dried .....*Astronidium victoriae* (*Astronia Pickeringii* var. *vitiensis* A. Gray).

It seems desirable to designate the variety *samoensis* as the actual type of *Astronia Pickeringii*, since Gray clearly specifies that the floral characters of his description refer to the Samoan plant; also, the correct combination of this specific name with *Astronidium* was first made by Christophersen (in Bishop Mus. Bull. **154**: 32. 1938) in connection with the variety *samoense* (A. Gray) Christoph. This varietal combination of Christophersen now seems unnecessary, if my view that the Fijian variety is specifically distinct is accepted.

No consequential differences are to be found between the types of *Astronia victoriae* and *Astronia Pickeringii* var. *vitiensis*, those pointed out by Gillespie being hardly important. Even on the type of *A. victoriae* the calyx-lobes are often 8–11 rather than regularly 8. Inflorescence-pubescence is an inconstant character and is found in varying phases of persistence on the above-cited specimens.

5. **Astronidium inflatum** (A. C. Sm.) comb. nov.

Astronia inflata A. C. Sm. in Bishop Mus. Bull. **141**: 114. *f. 60.* 1936.

VANUA LEVU: *Horne 616* (GH); Mbua: Navotuvotu, summit of Mt. Seatura, alt. 700–830 m., *Smith 1645* (Bish, GH, NY, UC, US) (slender tree 4 m. high, in dense forest; calyx pink); Thakaundrove: Mt. Mbatini, summit, alt. 1030 m., *Smith 707* (Bish, GH, NY, UC, US) (shrub 2 m. high, in dense thickets); Mt. Ndikeva, eastern buttress, alt. 800 m., *Smith 1875* (Bish, TYPE, GH, NY, UC, US) (tree 4 m. high, in crest thickets).

Since no material of the species has been obtained since the original description, this is not repeated. Although closely related to the more common *A. victoriae*, the present species may be readily distinguished on the basis of characters mentioned in the key.

6. **Astronidium robustum** (Seem.) comb. nov.

Astronia robusta Seem. Fl. Vit. 86. 1865; Triana in Trans. Linn. Soc. **28**: 152. 1871; Cogn. in DC. Monogr. Phan. **7**: 1096. 1891; Gillespie in Bishop Mus. Bull. **83**: 25. *f. 31.* 1931.

Tree to 20 m. high, the young parts glabrous or faintly puberulent and soon glabrescent, the branchlets stout, distally quadrangular, otherwise terete; petioles stout, shallowly canaliculate, 1.2–6 cm. long; leaf-blades chartaceous to subcoriaceous, elliptic, 11–27 cm. long, 5–17 cm. broad, subacute to attenuate at base, subacute or obtuse or obtusely cuspidate at apex, slightly recurved at margin, the principal nerves 5, arising from base or united up to 2.5 cm., impressed or plane above, prominent beneath, the marginal collecting-nerves faint, the cross-veins prominulous to faintly impressed above, sharply raised or prominulous beneath; inflorescence terminal, trichotomously cymose, often faintly puberulent, soon gla-

brescent, 5–10 cm. long and broad, the branchlets slightly flattened or quadrangular, the bracts papyraceous, obovate, about 15 by 8 mm. or larger, soon deciduous, the bracteoles 7 mm. long or more, caducous; flowers usually in threes, the pedicels 3–4 mm. long; calyx coriaceous, glabrous, often slightly verrucose or rugulose, cupuliform, 9–12 mm. long and in diameter at anthesis, the limb erect, about 5 mm. long at anthesis, irregularly splitting into 4–7 lobes, the lobes deltoid to broadly ovate, 2–5 mm. long, 3–8 mm. broad, acute or obtuse at apex; petals 6–9, usually 8, subcarnose, oblong, 10–12 mm. long, 4–6 mm. broad, rounded at apex; stamens 12–18, usually 16, the filaments carnose, ligulate, 8–12 mm. long, 1.5–2 mm. broad, the anthers oblong, 5–9 mm. long, stout, sharply recurved in the distal 3–4 mm., the basal spur obtuse, 1.5–2.5 mm. long; style carnose, columnar, 12–16 mm. long, the locules 6–9; fruit depressed-globose, 10–15 mm. in diameter at maturity, the mature placentas 6–9, clavate, 4–6 mm. long, conspicuously retuse at apex, the seeds oblong-clavate, slender, angled, 1–2.5 mm. long.

VITI LEVU: Namosi: Vicinity of Namosi, alt. 400–500 m., *Gillespie 2869* (Bish, NY, UC) (native name: *thava*), *Gillespie 2974* (Bish, UC); Rewa: Hill forests, alt. 500 m., *Parks 20396* (Bish, UC) (tree 20 m. high); Virea-Nasongo trail, alt. 400 m., *Parks 20456* (Bish, UC) (tree 6–8 m. high, in thick forest); Naitasiri: Korombamba Mt., *Meebold 16669* (Bish, NY); vicinity of Nasinu, alt. 150 m., *Gillespie 3403* (Bish, UC) (tree 8 m. high, in woods). TAVEUNI: Borders of lake east of Somosomo, alt. 700–900 m., *Smith 859* (Bish, GH, NY, UC, US) (spreading tree 6 m. high, in dense forest). WITHOUT DEFINITE LOCALITY: *Horne 200* (GH).

Although I have not examined the type (*Seemann 181,* from Namosi) in connection with all the cited specimens, I saw it at Kew in 1935 and noted that *Smith 859* was a good match. The species is very distinct in the large size of all its parts, as noted in the key.

7. **Astronidium sessile** (A. C. Sm.) comb. nov.

Astronia sessilis A. C. Sm. in Bishop Mus. Bull. **141**: 111. *f. 58.* 1936.

VANUA LEVU: Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, alt. 650–900 m., *Smith 533* (Bish, TYPE, NY) (shrub 2 m. high, in dry forest).

Since only the type collection is known, the original description is adequate.

8. **Astronidium macranthum** (A. C. Sm.) comb. nov.

Astronia macrantha A. C. Sm. in Bishop Mus. Bull. **141**: 113. *f. 59.* 1936.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, on edge of forest near Vatuthere, alt. 900 m., *Gillespie 4270* (Bish, GH, UC). VANUA LEVU: Mbua: Southern portion of Seatovo Range, alt. 100–350 m., *Smith 1525* (Bish, GH, NY, UC, US) (tree 7 m. high, in forest), *Smith 1706* (Bish, TYPE, GH, NY, UC, US) (small spreading tree 3–6 m. high, common in dry forest; petals white).

The original description of this species does not need amplification, except to note that the Gillespie specimen has leaf-blades up to 14 cm. long and 6.5 cm. broad. *Astronidium macranthum* is readily distinguished from *A. robustum* by foliage characters, but the two species are closely allied.

9. **Astronidium Degeneri** sp. nov.

Arbor parva ubique calyce obscure lepidoto excepto glabra, ramulis crassis subteretibus vel apicem versus quadrangulatis, internodiis brevibus; petiolis gracilibus obscure canaliculatis 2–4 cm. longis, laminis chartaceis vel subcoriaceis siccitate viridibus oblongo-ellipticis, 8–14 cm. longis, 3–6.5 cm. latis, basi obtusis, apice rotundatis vel obtusis, margine leviter recurvatis, 3-pli-nerviis, nervis ad 1 cm. interdum conjunctis supra subplanis vel leviter insculptis subtus prominentibus, nervis marginalibus 0.5–1 mm. intra marginem inconspicuis, venulis transversis supra subplanis subtus prominulis, rete venularum immerso; in-

florescentia terminali trichotome cymosa, 7–12 cm. longa, 9–17 cm. lata, ramulis complanatis, bracteis bracteolisque mox caducis, floribus plerumque ternatis subsessilibus, pedicellis inconspicuis ad 1 mm. longis; calyce coriaceo inconspicue ferrugineo-lepidoto cupuliformi, 8–9 mm. longo, circiter 7 mm. diametro, limbo sub anthesi erecto circiter 3.5 mm. longo in lobis 5 vel 6 ovato-deltoideis subacutis 2–3 mm. longis et 2–4 mm. latis rupto; petalis circiter 7 albis submembranaceis obovato-oblongis, 7–8 mm. longis, 3–4 mm. latis, apice rotundatis vel apiculatis, basim versus leviter angustatis; staminibus plerumque 14, filamentis carnosis ligulatis circiter 7 mm. longis, antheris oblongis 5–5.5 mm. longis apice conspicue recurvatis, calcare basilari subacuto circiter 1.5 mm. longo; stylo carnoso petalis subaequali, stigmate rotundato-truncato, loculis plerumque 7, placentis suberectis, ovulis numerosis.

Viti Levu: Tholo West: Yawe, vicinity of Mbelo, near Vatukarasa, alt. 300 m., *Degener 15279* (A, type), May 15, 1941 (small tree, in forest; petals white).

Compared with its nearest relatives, *A. macranthum* and *A. robustum*, the new species has fairly small flowers, which, however, are larger than those of such species as *A. victoriae* and its allies. In addition, the nearly sessile flowers readily distinguish *A. Degeneri*.

10. **Astronidium tomentosum** (Seem.) comb. nov.

Astronia tomentosa Seem. Fl. Vit. 86. 1865; Triana in Trans. Linn. Soc. **28:** 152. 1871; Cogn. in DC. Monogr. Phan. **7:** 1099. 1891.

Small tree or shrub, the young branchlets, petioles, lower surfaces of leaf-blades, inflorescence-branches, bracts, bracteoles, pedicels, and calyces densely and persistently lepidote with minute ciliolate or substellate scales less than 0.1 mm. in diameter, the branchlets stout, subterete; petioles shallowly canaliculate, 1.5–4 cm. long; leaf-blades coriaceous or subcoriaceous, glabrous above, elliptic- or ovate-oblong, 5–9 cm. long, 2–4.5 cm. broad, rounded or faintly cordate at base, obtuse at apex, narrowly recurved at margin, the nerves 3 or 5, ascending from base, slightly impressed above and prominent beneath, the marginal nerves obscure, the cross-veins subimmersed or slightly impressed above and prominulous beneath; inflorescence terminal, trichotomously cymose, 3–10 cm. long and slightly broader, the branchlets angled, the bracts chartaceous, obovate-linear, 4–7 mm. long, the bracteoles similar but 2–4 mm. long; flowers crowded, usually in threes, the pedicels inconspicuous, less than 1 mm. long; calyx subglobose in bud, 2.5–3 mm. in diameter before dehiscence; petals 5, broadly ovate and minute in bud; stamens 10 (very immature in our material); ovary-locules 5; fruit depressed-globose, 6–7 mm. in diameter at maturity, the mature placentas 5, suberect, clavate, about 2 mm. long, retuse or flattened at apex.

Viti Levu: Namosi: Voma Mt., on or near summit, alt. 900–1000 m., *Seemann 174* (GH, type coll.), *Gillespie 2725* (Bish), *2796* (Bish, UC); Vakarongasiu Mt., summit, alt. 950 m., *Gillespie 3281* (Bish).

This apparently very local species is not well named, the indument being essentially lepidote rather than tomentose. Although mature flowers are not yet available, the species is quite unmistakable.

11. **Astronidium Storckii** Seem. Fl. Vit. 87. 1865; Markgraf in Notizbl. Bot. Gard. Berlin **12:** 49. 1934.

Astronia Storckii Seem. in Bonplandia **10:** 296, nomen. 1862; Triana in Trans. Linn. Soc. **28:** 152. 1871; Cogn. in DC. Monogr. Phan. **7:** 1099. 1891.

Small tree, to 5 m. high (or more?), the young branchlets, petioles, lower surfaces of leaf-blades, inflorescence-parts, and calyx subhispid with persistent simple subulate brown hairs 1–2.5 mm. long, the branchlets stout, subterete or distally quadrangular; petioles shallowly canaliculate, 3.5–6.5 cm. long; leaf-blades subcoriaceous, sparsely hispid above and glabrescent except on nerves,

elliptic, 10–22 cm. long, 4–11 cm. broad, obtuse or rounded at base, gradually short-acuminate at apex, slightly recurved at margin, the principal nerves 5, oriented from base, slightly impressed above and prominent beneath, the marginal collecting-nerves faint, the cross-veins slightly impressed above and sharply raised beneath; inflorescence terminal, trichotomously cymose, 8–10 cm. long, 10–17 cm. broad, the branchlets lightly quadrangular, the bracts chartaceous, obovate-oblong, 7–12 mm. long, the bracteoles similar but smaller; flowers crowded, the pedicels 1 mm. long or less; calyx ovoid and closed in bud; petals 4 or 5 (or 6?), deltoid-ovate in bud; stamens apparently 8 or 10 (or 12?); ovary 4-celled (ex Seemann) or 5- or 6-celled; mature fruit 7–10 mm. in diameter, the mature placentas often 6 (in our material), suberect, clavate, about 2.5 mm. long, lightly retuse at apex.

Viti Levu: Namosi: Naitarandamu Mt., summit, alt. 1200 m., *Gillespie 3133* (Bish, UC); Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13745* (A) (tree 5 m. high, in forest).

The type of this species is *Storck 890,* from Ovalau, for which Seemann reports the native name *thavathava.*

12. **Astronidium kasiense** sp. nov.

Astronidium Storckii sensu A. C. Sm. in Bishop Mus. Bull. **141**: 115. 1936; non Seem.

Arbor ad 7 m. alta, ramulis novellis, petiolis, foliis subtus, ramulis inflorescentiae, bracteis, bracteolis, et calycibus dense et arcte tomentellis vel puberulis (pilis ferrugineis persistentibus simplicibus saepe clavatis 0.2–0.5 mm. longis); ramulis crassis apicem versus quadrangulatis; petiolis crassis obscure canaliculatis 3–7 cm. longis, laminis chartaceis ovato-ellipticis, 13–23 cm. longis, 7–12 cm. latis, supra olivaceis glabris saepe rugulosis, basi rotundatis vel obscure subcordatis, apice gradatim et breviter acuminatis, margine paullo recurvatis, 5-pli-nerviis, nervis ad 7 mm. interdum conjunctis supra leviter impressis subtus prominentibus, nervis marginalibus circiter 1 mm. intra marginem subtus prominulis, venulis transversis numerosis supra planis vel insculptis subtus valde prominulis, rete venularum intricato subtus prominulo; inflorescentia terminali trichotome cymosa, ad 15 cm. longa et lata, ramulis crassis leviter angulatis, bracteis oblongis ad 6 mm. longis et 3 mm. latis, bracteolis similibus sed minoribus, floribus juvenilibus subsessilibus dense aggregatis; calyce in alabastro clauso ellipsoideo; petalis 4 in alabastro late ovatis; staminibus 8; stylo crasso, stigmate rotundato-truncato; ovario 4-loculare, placentis immaturis clavatis quam longis latioribus.

Vanua Levu: Thakaundrove: Yanawai River region, Mt. Kasi, alt. 300–430 m., *Smith 1799* (Bish, GH, NY, TYPE, UC, US), May 10, 1934 (tree 7 m. high, in dense forest; native name: *rusila*).

In comparing this specimen with the type of *A. Storckii* at Kew, I was inclined in 1935 to consider them conspecific, but more careful comparison with the recent collections of *A. Storckii* indicates that dependable characters of pubescence make advisable the description of this new species. The two species are quite similar in shape, texture, and venation of leaf-blades.

ONAGRACEAE

Jussiaea erecta L. Sp. Pl. 388. 1753; Setchell in Carn. Inst. Publ. **341**: 61. 1924; Christoph. in Bishop Mus. Bull. **128**: 160. 1935.

Viti Levu: Tholo North: Korovou, east of Tavua, alt. 30–75 m., *Degener 14963* (A) (along stream in dry meadow; native name: *naingisa*).

This species and the following are naturalized weeds which apparently have previously escaped collection in Fiji. The family, as far as I can ascertain, is not otherwise represented by Fijian herbarium material.

Jussiaea suffruticosa L. Sp. Pl. 388. 1753.

Viti Levu: Tholo North: Nandarivatu, alt. about 800 m., *Degener & Ordonez 13545* (A) (shrub 1–2 m. high, along stream in sun).

The cited specimen is apparently a very pubescent form of the widespread species.

UMBELLIFERAE

Hydrocotyle javanica Thunb. Diss. Hydrocot. 6. *pl. 1.* 1798.

Taveuni: Western slope, between Somosomo and Wairiki, alt. 300–600 m., *Smith 915* (GH, NY) (in dense mats in forest).

The cited specimen closely matches material from India, Sumatra, Java, New Guinea, etc., but I believe that the species has not otherwise been reported from our region. Nothing in its habitat causes me to believe that the plant was introduced or escaped in Taveuni, but of course this may have been the case. The determination is by Dr. B. H. Danser.

MYRSINACEAE

Embelia gracilis Turrill in Jour. Linn. Soc. Bot. **43**: 30. 1915.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. about 750 m., *Degener 14307* (A) (liana, scrambling over bushes in forest; flowers whitish; fruit red, succulent); Sovutawambu, near Nandarivatu, alt. about 750 m., *Degener 14662* (A) (liana, in forest); Ra: Vatundamusewa, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15453* (A) (liana, in partly sunny forest; fruit red; native name: *wandrenga*); Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, alt. 300 m., *Degener 15259* (A) (liana, in forest); Yawe, near Mbelo, *Degener 15268* (A) (liana, in forest; fruit red; native name: *wakai*); Serua: Vatuvilakia, near Ngaloa, alt. 90 m., *Degener 15163* (A) (liana, in forest).

It is remarkable that the present collection contains six numbers of *Embelia,* which up to the present seems to have been represented from Fiji only by the type of *E. gracilis.* Although I have not seen this type, Degener's numbers *14307* and *14662* match the original description in all details; these numbers, from essentially the type-locality, have the leaves punctate with abundant pellucid glands. The remaining cited numbers were collected at much lower elevations and have the leaves with comparatively few and subopaque glands. In other respects I can find no essential differences among the specimens. Numbers *14307, 14662,* and *15163* bear inflorescences, which are identical in all respects. The remaining specimens, and also *14307,* are in fruit, showing no characters of difference. The lowland collections show considerable variation in leaf-size, *15453* having blades up to 5 cm. long and 3.5 cm. broad, but various leaf-sizes may be found on the same specimens. I assume that the variation in leaf-punctation depends upon whether or not the plant grows in deep shade, but it is conceivable that the collection of additional material will permit the recognition of two forms or even species.

OLEACEAE

By C. E. Kobuski

Jasminum Smithianum Kobuski, sp. nov.

Frutex subscandens, ramulis griseis, hornotinis viridibus puberulis. Folia opposita, trifoliolata, coriacea vel chartacea, glabrescentia, petiolis puberulis, 1.0–1.5 cm. longis, foliolis ovatis parvis 1–3 cm. longis et 0.8–1.5 cm. latis basi rotundatis vel truncatis, apice acutis, supra atrovirentibus, nitidis, subtus pallidioribus, juventute margine et costa subtus puberulis, venis supra impressis, subtus elevatis,

infimis longe adscendentibus, ceteris 2–3 (paribus) arcuatis intramarginale conjunctis, petiolulis puberulis ad 0.5 cm. longis. Inflorescentia axillaris cymosa. Bracteoli 2, lineari-acuminati, pubescentes, ca. 2 mm. longi. Calyx dense puberulus, tubo ca. 2 mm. longo, fauce ca. 1.5 mm. diametro, lobis 5 minutissime subulatis vel haud manifestis. Corolla parva, alba, tubo 5.0–5.5 mm. longo, fauce ca. 1.5 mm. diametro, lobis 5, ovatis vel obovatis, ca. 3 mm. longis et 2.5 mm. latis. Stamina 2, exserta, filamentis 3 mm. longis basi corollam 2.5 mm. adnatis, antheris linearibus 3 mm. longis. Fructus ignotus.

VITI LEVU: Nandi: Korovou, near Nandi, among rocks along arid coast, *Degener 15321* (A, TYPE), May 27, 1941 (subscandent shrub with white flowers).

This species is characterized by very small, shining, dark green, trifoliolate leaves, pubescent when young, especially on the lower midrib, in the angles of the veins and along the margin. The flowers are correspondingly small with pubescent calyx-lobes, bracteoles and pedicels. The stamens are exserted. The closest relative is *J. Degeneri,* which has similar flower structure and pubescence but much larger, opaque, membranaceous leaves and a distinctly climbing habit. Also somewhat closely allied is *J. didymum* Forst., which can be separated, however, by the strictly glabrous, larger leaves.

This species is named in honor of Dr. A. C. Smith, the author of this paper, whose interest in and work on the Fijian flora are well known.

Jasminum Degeneri Kobuski, sp. nov.

Scandens, ramulis brunneis, hornotinis aureo-viridibus puberulis. Folia opposita, trifoliolata, membranacea vel chartacea, glabrescentia, petiolis puberulis 0.8–1.5 cm. longis, foliolis ovatis (2.5–) 3–5 (–6) cm. longis et (1.5–) 2–3 (–4) cm. latis, basi truncatis vel rotundatis, apice acuminatis, juventute costa subtus subpuberulis, venis undique elevatis, 3–4 paribus adscendentibus, petiolulis puberulis 0.6–1.0 cm. longis. Inflorescentia axillaris, cymosa. Bracteoli linearilanceolati, pubescentes, 1 mm. vel minus longi. Calyx dense puberulus, tubo ca. 2 mm. longo, lobis 5, minutissime setaceis vel haud manifestis. Corolla alba, parva, tubo 7–9 mm. longo et fauce ca. 1 mm. diametro, lobis 5, ovatis vel obovatis, ca. 3 mm. longis et 2.0–2.5 mm. latis. Stamina 2, inclusa, filamentis ca. 3 mm. longis, corollam totis vel interdum partim adnatis, antheris linearibus 3 mm. longis. Fructus ignotus.

VITI LEVU: Tholo North: Fatia, west of Tavua, alt. 30–150 m., *Degener 14980* (A, TYPE), April 2, 1941 (liana with white flowers). PRECISE LOCALITY LACKING: *U. S. Expl. Exped.* (GH).

As stated under the previous species, a close relationship exists between *J. Smithianum* and *J. Degeneri.* Both are trifoliolate, small-flowered and pubescent on the flowers as well as on the very young growth. In this species, the leaves are opaque, membranaceous, and considerably larger, with the veins raised on both surfaces and not anastomosing into a second margin. The stamens, although possessing approximately the same measurements, are included, and the corolla is about 2 mm. longer.

LOGANIACEAE

Geniostoma vitiense Gilg & Benedict in Bot. Jahrb. **56:** 542. 1921.

Geniostoma rupestre var. *puberulum* A. Gray in Proc. Am. Acad. **4:** 321, nomen. 1859.

VANUA LEVU: Mbua: Rukuruku Bay, *Parham 5* (GH); Thakaundrove: Eastern drainage of Yanawai River, alt. 60 m., *Degener & Ordonez 14104* (A) (shrub, in open forest); hills south of Nakula Valley, alt. 10–30 m., *Smith 326* (GH, NY) (shrub 3 m. high, in woods); Maravu, near Salt Lake, alt. 90 m., *Degener & Ordonez 14233* (A) (tree 5 m. high, on reed-covered forehill). WITHOUT DEFINITE LOCALITY: *Seemann 301* (GH, TYPE COLL.); *U. S. Expl. Exped.* (GH, as *G. rupestre* var. *puberulum*).

Previously reported only from the type collection, *G. vitiense* appears to occur fairly commonly, being distinguishable from *G. rupestre* by its pubescence and floral characters. The leaves of the type are somewhat smaller than the average of the other cited specimens; leaf-blades sometimes attain a size up to 12 cm. long and 6.5 cm. broad.

Geniostoma stenocarpum sp. nov.

Frutex vel arbor parva ad 3 m. alta, ramulis subteretibus fusco-cinereis juventute interdum ferrugineo-puberulis mox glabris; stipulis parvis rotundato-ovatis mox glabris; petiolis gracilibus leviter canaliculatis 2–5 mm. longis, laminis chartaceis glabris in sicco fuscis anguste elliptico-oblongis, 4–7 cm. longis, 1.2–2.5 cm. latis, basi acutis vel attenuatis et in petiolum decurrentibus, apice subacutis et saepe mucronulatis, margine integris et leviter recurvatis, costa supra insculpta subtus prominente, nervis secundariis utrinsecus 4–6 adscendentibus supra planis vel leviter insculptis subtus paullo elevatis, venulis immersis; inflorescentiis 1–3 in axillis foliorum cymosis gracilibus sub anthesi 7–15 mm. longis paucifloris, pedunculo et ramulis secundariis paucis brevibus glabris, bracteis acutis ovato-deltoideis 0.5–1 mm. longis; pedicellis gracilibus sub anthesi 2–3 mm. sub fructu ad 6 mm. longis, decidue 2- vel 4-bracteolatis, bracteolis oppositis vel suboppositis adpressis oblongis circiter 0.8 mm. longis margine ciliolatis; lobis calycis submembranaceis anguste imbricatis ovato-lanceolatis, 0.7–1 mm. longis, apice acutis, extus puberulis, intus glabris; corolla membranacea breviter tubulosa sub anthesi 2.5–3 mm. longa et 3 mm. diametro, extus obscure puberula vel basim versus glabra, tubo pilis brevibus albidis intus distaliter retrorso-piloso, lobis 5 ovato-oblongis circiter 1.6 mm. longis et 1.4 mm. latis subacutis margine ciliolatis uninervatis, nervo distaliter pauciramoso; staminibus fauce insertis, filamentis deltoideo-ligulatis circiter 0.6 mm. longis intus pilis circiter 0.4 mm. longis retrorse barbato-hirsutis, antheris oblongis circiter 0.8 mm. longis, apice obtusis, basi cordatis; ovario glabro depresso-globoso sub anthesi circiter 1 mm. diametro, stylo gracili circiter 0.7 mm. longo, stigmate subgloboso circiter 0.5 mm. diametro papilloso; fructibus anguste ellipsoideis, 7–10 mm. longis, 2.5–3 mm. latis, basi obtusis, apice attenuatis et stylo persistente coronatis, valvis maturis apertis, placentis persistentibus semina numerosa gerentibus.

Viti Levu: Tholo North: Vicinity of Nandarivatu, alt. 750–850 m., *Degener & Ordonez 13591* (A, type), Nov. 22, 1940 (shrub, in rain-forest; flowers whitish), *Degener & Ordonez 13592* (A) (shrub about 1 m. high; flowers yellowish white), *Degener 14314* (A) (small tree to 3 m. high, in open forest).

Geniostoma stenocarpum is characterized by its glabrous comparatively small and narrow leaf-blades, which are acute at the base, its short corollas and conspicuously barbate filaments, and its comparatively long and narrow fruits. In floral characters it resembles *G. vitiense* Gilg & Benedict, but that species has more persistently pubescent branchlets and leaf-blades, which are rounded at the base, pilose on the lower surface (persistently so on the costa), and generally larger.

Geniostoma rupestre Forst. has doubtless been too broadly interpreted, as suggested by Gilg and Benedict (in Bot. Jahrb. **56**: 542. 1921). However, if I correctly understand their analysis, based on a duplicate of the type, it is the common lowland species in Fiji, characterized by its strictly glabrous habit and shining leaves. Its corolla-tube at anthesis is longer than the lobes and its throat is uniformly pilose with short spreading hairs; each lobe is supplied by 3 nerves which separate at the base of the corolla and then ascend without further branching. On the other hand, both *G. vitiense* and *G. stenocarpum* have the corolla-tube about equal to the lobes and its throat pilose with reflexed hairs; each lobe is supplied by a single nerve, which divides into 3 only at the summit of the tube,

each branch usually being further divided distally. Some of Gray's varieties (*nomina nuda* in Proc. Am. Acad. **4**: 321. 1859) of *G. rupestre* should be referred to other species.

Geniostoma calcicola sp. nov.

Frutex scandens ad 50 cm. altus, ramulis gracilibus subteretibus fusco-cinereis juventute breviter et densissime pallido-setosis demum glabris; stipulis parvis late ovatis; petiolis gracilibus 3–5 mm. longis ut ramulis hirsutis, laminis chartaceis in sicco fuscis vel olivaceis oblongo-ellipticis, 3.5–5 cm. longis, 1.5–2.5 cm. latis, basi obtusis, apice rotundatis vel leviter emarginatis et interdum inconspicue mucronulatis, margine integris et leviter recurvatis, utrinque pilis pallidis circiter 0.3 mm. longis erectis pilosis, costa supra leviter impressa subtus elevata, nervis lateralibus utrinsecus 4–6 brevibus supra immersis subtus leviter prominulis, venulis immersis; inflorescentiis axillaribus plerumque solitariis gracilibus cymosis sub anthesi 8–12 mm. longis paucifloris, pedunculo brevi et ramulis paucis pallide puberulis, bracteis ovatis minutis; pedicellis gracilibus sub anthesi 2–5 mm. longis decidue 2–4-bracteolatis, bracteolis membranaceis adpressis oblongo-lanceolatis acutis ciliolatis circiter 1 mm. longis; calyce cupuliformi fere ad basim 5-lobato, lobis membranaceis acutis ovato-deltoideis, 1.2–1.5 mm. longis et latis, sparse glanduloso-punctatis, margine ciliolatis; corolla membranacea breviter tubulosa sub anthesi 3.5–4 mm. longa extus glabra, tubo circiter 2.5 mm. diametro pilis laxis patentibus pallidis circiter 0.8 mm. longis intus dense piloso, lobis 5 sub anthesi reflexis oblongo-ovatis, circiter 1.5 mm. longis et 2 mm. latis, apice obtusis, uninervatis, nervo distaliter pauciramoso; staminibus fauce insertis, filamentis ligulatis circiter 0.4 mm. longis parce pilosis, antheris oblongis circiter 1 mm. longis, apice obtusis, basi cordatis; ovario glabro depresso-globoso sub anthesi circiter 1.3 mm. diametro, stylo circiter 1 mm. longo, stigmate subgloboso circiter 0.8 mm. diametro papilloso.

FULANGA: Near Monothaki, *Smith 1116* (GH, TYPE, NY), Feb. 22, 1934 (scandent shrub, to 50 cm. high, on cliff face in limestone formation; corolla white).

Geniostoma calcicola is typified by a specimen to which I referred (in Bishop Mus. Bull. **141**: 125. 1936) as a relative of *G. crassifolium* Benth. It differs sharply from that New Caledonian species, however, in its low habit and much smaller leaves. In floral characters, *G. calcicola* is allied to *G. vitiense* Gilg & Benedict and the type specimen has a very similar indument, but in habit and foliage the two species are easily distinguished.

I have seen three specimens which are very similar in habit and flowers to the type of *G. calcicola: Smith 1203* (GH, NY), from Fulanga, *Seemann 300* (GH), from Fiji but without definite locality, and *U. S. Expl. Exped.* (GH), from Tonga, determined by Gray as *G. rupestre* var. *ellipticum*. However, these three specimens have the branchlets and leaves entirely glabrous or only obscurely puberulent, and their corollas lack the conspicuous lax hairs described above, being merely puberulent within. I am at a loss to know how much value to attach to characters of pubescence in this case, especially since one of the specimens is from Fulanga. Before deciding whether the concept of *G. calcicola* should be extended to include this glabrous form, I should like to see additional material of the complex from southern Lau and Tonga.

COUTHOVIA A. Gray

It has been customary to place the Fijian specimens of *Couthovia* in two species, *C. corynocarpa* A. Gray and *C. Seemanni* A. Gray. The first of these, which is the genotype, was based on a fruiting specimen collected by the U. S.

Exploring Expedition, the second on *Seemann 305,* a flowering specimen. In proposing *C. Seemanni,* Gray (in Proc. Am. Acad. **5**: 320. 1862) expressed doubt of its distinctness from *C. corynocarpa.* In order to decide whether or not these plants are conspecific, I have compared type material of each and have examined an extensive series of more recently collected Fijian specimens of the genus. The two type collections agree very closely in all essential details; some of the leaves of *C. corynocarpa* appear to be slightly smaller, but it is to be noted that these small leaves are accompanied by others on the same branchlets which are as large as those of the type of *C. Seemanni.* It appears to be a characteristic of this species to bear occasional short branchlets, near the apices of branches, which have a pair of small and presumably juvenile leaves. *Seemann 305* (GH) also shows these small apical leaves. In spite of the lack of flowers from the type collection of *C. corynocarpa,* I have no doubt that the two plants under consideration are conspecific.

Gray, in proposing *C. Seemanni* as a distinct species, was probably influenced by Seemann's field notes, which remark upon the difference in habit between *Seemann 305* and *Seemann 303,* the latter of which Gray (in Proc. Am. Acad. **5**: 320. 1862) had identified as *C. corynocarpa.* While Seemann was certainly correct in referring his numbers *305* and *303* to different species, I cannot agree with either him (Fl. Vit. 165. 1866) or Gray that no. *303* represents *C. corynocarpa.* Seemann apparently saw only these two specimens of *Couthovia.* To revise his treatment: no. *305,* the type of *C. Seemanni,* is referable to *C. corynocarpa,* while no. *303,* determined as *C. corynocarpa,* represents an undescribed species. I refer the latter specimen to *C. macrocarpa.*

Gillespie's treatment of the genus (in Bishop Mus. Bull. **83**: 28–29. *fig. 35, 36.* 1931) further complicates the situation. He states that the subject of Seemann's *pl. 32* "can not be other than" *Seemann 305.* This is certainly not the case. *Seemann 305* has the pubescence of the corolla limited to the throat, while Seemann's *pl. 32* shows the tube also pubescent below the throat. Furthermore, there is nothing in Seemann's text to indicate that his no. *305* was accompanied by fruits, and a fruit is illustrated on *pl. 32.* The only number which Seemann cites as *C. corynocarpa* is his no. *303,* and this surely is the basis of his *pl. 32.* This specimen, like the plate, shows the corolla-tube to be uniformly pilose within and is accompanied by a large woody fruit identical with that illustrated. Furthermore, Seemann says that *C. corynocarpa* (i.e. no. *303*) has "dark-green foliage (made rather too light by our colourist)." The specimen of *Seemann 303* bears out this observation.

In referring a series of several small-leaved specimens to *C. corynocarpa,* Gillespie appears to have depended upon a photograph of the type collection in the Gray Herbarium. He remarks that "the leaves of the Gray specimen are about 11 cm. long and 5 cm. broad, somewhat larger than those of our collections." While this is true, it must be further remarked that other sheets of the Exploring Expedition type collection of *C. corynocarpa* (at NY, US) have the leaf-blades up to 13.5 by 10 cm. It is noteworthy that the small-leaved specimens referred by Gillespie to *C. corynocarpa* occur at elevations of 500–1300 meters, while the type doubtless came from a low elevation. From a re-examination of the material, I must conclude that Gillespie's description and illustration of *"C. corynocarpa"* refer to an unnamed species, which I shall call *C. collina.* His description and illustration of *C. Seemanni* are referable to *C. corynocarpa,* but the specimens cited are referable only in part to *C. corynocarpa.* Three of them (*Parks 20869,*

Gillespie 2095 and *2433*) represent the new species which I shall call *C. alata,* while one other (*Gillespie 2590*) represents my *C. macrocarpa.*

I have discussed past interpretations of this complex in some detail, since it now appears that six well-marked species of *Couthovia* are distinguishable in Fiji. Therefore, the proper placing of Gray's two names is essential. It seems unfortunate that these names are synonyms, but on the basis of the extensive material at hand I find it necessary to make this reduction and to propose the other five species as new. All of the six Fijian species appear to be endemic; they have been carefully compared with the other species of the genus thus far described from the Pacific (i.e. *C. neo-ebudica* Guillaumin from the New Hebrides, *C. novocaledonica* Gilg and Benedict from New Caledonia, and *C. calophylla* Gilg & Benedict and *C. Toua* Kanehira from Micronesia). An interesting discussion of the genus and a treatment of nine Papuasian species was published by Gilg & Benedict (in Bot. Jahrb. **54**: 174–183. *fig. 8, 9.* 1916).

Of the Fijian species, *C. corynocarpa* is the most abundant, at least at low elevations; it is characterized by its smooth stipules, large petiolate leaves, and glabrous corolla-tube. With essentially similar flowers are *C. collina, C. alata,* and *C. macroloba,* but each is easily recognized by one or more obvious characters. The two remaining Fijian species, *C. macrocarpa* and *C. pachyantha,* have the corolla-tube pilose within as well as barbate at its apex, and they are further distinguished by their large fruits. It seems likely that all of these species have been derived from *C. corynocarpa* and therefore are more closely related to each other than to any of the non-Fijian species.

Key to the Fijian species

Corolla barbate at throat within, otherwise glabrous; style less than 1 mm. long; mature fruit obovoid, clavate, comparatively slender, not more than 13 mm. in diameter.
- Stipules forming a sheath 2–5 mm. high; leaf-blades obovate-oblong, 4.5–9 cm. long, 2–5 cm. broad; occurring above 500 m. ..... 1. *C. collina.*
- Stipules forming a sheath 4–15 mm. high; leaf-blades (9–) 11–25 cm. long and 5–12 cm. broad or larger.
  - Petioles 4–10 mm. long or more, sometimes angled but scarcely winged; leaf-blades broadly elliptic, the secondaries usually spreading; corolla 4–6 mm. long, the lobes 2–2.5 mm. long, thin-carnose; anthers 1.3–1.5 mm. long. ..... 2. *C. corynocarpa.*
  - Petioles very short, conspicuously winged, the wings 1–3 mm. broad, confluent with those of the opposite petiole (i. e. the stipule-sheaths horizontally winged); leaf-blades oblong-obovate, the secondaries ascending; flowers as in the preceding. 3. *C. alata.*
  - Petioles essentially none; leaf-blades obovate-elliptic, the secondaries ascending; corolla 6.5–7 mm. long, the lobes 3–4 mm. long, thick-carnose; anthers 1.8–2 mm. long. 4. *C. macroloba.*

Corolla barbate at throat within and also pubescent toward base of tube within; style 1.5–2.5 mm. long; mature fruit elliptic-obovoid, gradually narrowed or rounded toward base, often somewhat flattened, 18–28 mm. broad; leaf-blades broadly elliptic, the secondaries spreading.
- Corolla thin-carnose, the tube 2.5–3 mm. in diameter, the lobes 1.5–2 mm. broad; hairs at base of lobes lax, 0.5–0.7 mm. long; corolla-tube tomentellous within, the hairs lax, tangled ..... 5. *C. macrocarpa.*
- Corolla thick-carnose, the tube 4–5 mm. in diameter, the lobes 2.5–3 mm. broad; hairs at base of lobes stiff, about 1.3 mm. long; corolla-tube strigose within, the hairs stiff. 6. *C. pachyantha.*

1. **Couthovia collina** sp. nov.

Couthovia corynocarpa sensu Gillespie in Bishop Mus. Bull. **83**: 28 (quoad descr.). *fig. 35.* 1931; non A. Gray.

Couthovia Seemannii sensu Gibbs in Jour. Linn. Soc. Bot. **39:** 157. 1909; non *C. Seemanni* A. Gray.

Frutex vel arbor ad 5 m. alta (vel ultra?) corolla intus barbata excepta glabra, ramulis fuscis subteretibus saepe striatis, internodiis junioribus 0.5–3 cm. longis; stipulis interpetiolaribus subcoriaceis, apice rotundatis, inter sese et cum petiolis connatis et cupulam 2–5 mm. altam formantibus, non longitudinaliter fissis; petiolis gracilibus supra complanatis vel leviter canaliculatis 2–9 mm. longis (supra stipulas); laminis plerumque subcoriaceis et obovato-oblongis, 4.5–9 cm. longis, 2–5 cm. latis, basi attenuatis vel raro obtusis, apice rotundatis vel late obtusis, margine saepe paullo revolutis, utrinque subnitidis, costa supra leviter elevata subtus prominente, nervis secundariis utrinsecus 5–10 patentibus subrectis supra paullo subtus manifeste elevatis, rete venularum laxe reticulato immerso vel inconspicue prominulo; floribus in apice ramulorum in corymbos 1–3 (cymosos, cymis 2- vel 3-plo divisis) dispositis, pedunculis ad 4 cm. longis gracilibus, cymae ramulis primariis 2–10 mm. longis, pedicellis subnullis bracteis inconspicuis ovatis acutis circiter 1 mm. longis; calyce papyraceo cupuliformi fere ad basim 5-lobato, lobis anguste imbricatis orbiculari-oblongis, 1.2–1.5 mm. longis, 1.5–2 mm. latis, apice rotundatis, margine minute ciliolatis; corolla subcarnosa obscure luteo-glandulosa 4–5.5 mm. longa, lobis oblongis, 2–2.5 mm. longis, 1.2–1.5 mm. latis, apice subacutis et saepe incrassatis, tubo 2–3 mm. diametro apice pilis rectis 1–1.3 mm. longis dense barbato cetera glabro; staminibus 5 tubo insertis, filamentis gracilibus 0.5–0.7 mm. longis, antheris oblongis 1.3–1.6 mm. longis glabris vel basi minute puberulis; ovario ellipsoideo luteo-glanduloso minute puberulo mox glabro, stylo 0.4–0.8 mm. longo, stigmate subcapitato minute papilloso; fructibus obovoideis clavatis, 16–22 mm. longis, 7–10 mm. diametro, infra medium vel basim versus abrupte contractis, apice rotundatis et mucronulatis.

Viti Levu: Tholo North: Loma Langa Mt., alt. 1050 m., *Gillespie 3913* (Bish, TYPE, NY, UC), Nov. 21, 1927 (in forest on slopes); summit of Loma Langa Mt., alt. 1200 m., *Gillespie 3929* (Bish); vicinity of Nandarivatu, alt. 750–1200 m., *Degener 14370* (A) (shrub, in forest; fruit whitish; native name: *ngingila*), *Gillespie 3969* (Bish, UC) (latex milky; flowers and fruit white; native name: *nduva*), *Parks 20740* (Bish, UC) (shrub 2–4 m. high, in dense forest; flowers waxy-white; fruit white); Namosi: Slope of Voma Mt., alt. 500 m., *Gillespie 2908* (Bish, NY) (native name: *kau toi*); Naitarandamu Mt., alt. 800 m., *Gillespie 3100* (Bish, UC) (flowers white, odorless). Vanua Levu: Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, alt. 650–900 m., *Smith 552* (Bish, GH, NY, UC, US) (tree 5 m. high, in dry forest; corolla and anthers white; fruit white at maturity; native name: *theketheke*).

Thus far this small-leaved species has been found only at comparatively high elevations on the two larger islands. Although its floral characters and its fruits are essentially similar to those of *C. corynocarpa* A. Gray, it is readily distinguished by its smaller and more compact habit, small leaves and stipules, and compact inflorescences.

2. **Couthovia corynocarpa** A. Gray in Proc. Am. Acad. **4:** 324. 1859.

Couthovia Seemanni A. Gray in Proc. Am. Acad. **5:** 320. 1862; A. Gray in Bonplandia **10:** 37. 1862; Seem. in Bonplandia **10:** 296. 1862; Seem. Fl. Vit. 166. 1866; Gillespie in Bishop Mus. Bull. **83:** 29, in part (as *C. seemannii*). *fig. 36.* 1931.

Gaertnera barbata Seem. ex A. Gray in Bonplandia **10:** 37, nomen. 1862.

Spreading shrub or tree up to 15 m. high, glabrous throughout except for the barbate corolla-tube, the branchlets stout, dark brown or stramineous, often obviously lenticellate, subterete or distally quadrangular, the distal internodes 1.5–8 cm. long; stipules interpetiolar, often coriaceous, subtruncate or rounded at apex, connate with the petiole-bases and forming a cupuliform tube 4–15 mm. high which occasionally splits longitudinally; petioles stout, shallowly canaliculate, the free portion 4–10 (–30) mm. long, often angled but not winged; leaf-blades

chartaceous or subcoriaceous, broadly elliptic, (9–) 11–25 (–40) cm. long, (4–) 6–17 (–28) cm. broad, acute or subattenuate at base, obtuse at apex, often slightly recurved at margin, usually dull on both surfaces, the costa stout, usually slightly raised above and prominent beneath, the secondary nerves 5–10 per side, spreading, nearly straight, raised on both surfaces, the veinlet-reticulation lax, often immersed, sometimes slightly prominulous especially beneath; flowers arranged in 1–4 corymbs at the apices of branchlets, the common peduncle, if present, short and stout, the secondary peduncles to 7 cm. long, the corymbs cymose, 3 or 4 times divided, the primary branchlets of the cymes 6–30 mm. long, the flowers sessile, often paired at ends of short ultimate branchlets, the bracteoles deltoid, about 0.7 mm. long; calyx papyraceous, cupuliform, minutely yellow-glandular, deeply 5-lobed, the lobes narrowly imbricate, orbicular-oblong, 0.7–1.5 mm. long, 1.2–2 mm. broad, rounded at apex, glabrous or minutely ciliolate at margin; corolla submembranous at base, thin-carnose distally, 4–6 mm. long, the lobes oblong-deltoid, 2–2.5 mm. long, 1.2–1.7 mm. broad, subacute and often slightly thickened at apex, the tube 2–3 mm. in diameter, barbate at apex with straight hairs 0.8–1.3 mm. long, otherwise glabrous; stamens 5, inserted on the tube, the filaments slender, 0.8–1.3 mm. long, the anthers oblong, 1.3–1.5 mm. long, puberulent at base or glabrous; ovary ellipsoid, glabrous, sparsely yellow-glandular, the style 0.5–1 mm. long, the stigma minutely capitate; fruits obovoid, clavate, 15–30 mm. long, 8–11 mm. broad, sharply contracted slightly below middle or nearer base, acute to rounded at apex and often conspicuously mucronulate.

Viti Levu: Tholo West: Mbuyombuyo, near Namboutini, *Tabualewa 15597* (A) (tree 10 m. high, in forest); Serua: Thulanuku, vicinity of Ngaloa, alt. 30 m., *Degener 15118* (A) (tree 4–5 m. high, in forest; flowers white); Namosi: Naitarandamu Mt., alt. 1000 m., *Gillespie 3344* (Bish, UC); Rewa: Vicinity of Suva Bay, alt. near sea-level, *Parks 20030* (Bish, UC) (tree 5 m. high, in dense bush on edge of swamp; fruit green), *Bryan 381* (A, Bish) (tree 5–6 m. high; fruit light green to white), *Meebold 16440* (Bish); Naitasiri: Vicinity of Nasinu, alt. 150 m., *Gillespie 3521* (Bish, UC), *3534* (Bish, UC); near Tamavua, alt. 150 m., *Gillespie 2195* (Bish, UC); Waindina River basin, alt. 50 m., *MacDaniels 1037* (Bish) (tree 15 m. high, in rain-forest). Ovalau: *U. S. Expl. Exped.* (GH, NY, US, type); *Seemann 305* (GH, type coll. of *C. Seemanni* and source of the name *Gaertnera barbata*); mountains south of Levuka, alt. 350 m., *Gillespie 4537* (Bish, NY, UC) (fruit white); near summit of main range west of Levuka, alt. 500 m., *Gillespie 4426* (Bish, UC). Kandavu: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 200* (Bish, GH, NY, US, UC) (tree or shrub 5 m. high, in forest; fruit white). Vanua Levu: Mbua: Lower Wainunu River Valley, alt. 0–200 m., *Smith 1726* (Bish, GH, NY, US, UC) (tree 4–10 m. high, in thin forest; corolla pale yellow; fruit white; native name: *mbulei*); Thakaundrove: Eastern drainage of Yanawai River, alt. 120 m., *Degener & Ordonez 14082* (A) (small tree, in forest; fruit white); Vatunivuamonde Mt., Savu Savu Bay region, alt. 300 m., *Degener & Ordonez 14024* (A) (small tree, in dense forest); southern slope of Mt. Mariko, alt. 400–600 m., *Smith 408* (Bish, NY, US) (shrub 3 m. high; flowers white; native name: *theketheke*).

As indicated by the above citations, this species has a wide range throughout Fiji at low elevations; its occurrence above 500 meters is indicated only by *Gillespie 3344* and must be unusual. That the type collection was obtained on Ovalau is evident from the following notes of Pickering (Geogr. Distr. of Animals and Plants, pt. 2: 358. 1876): "Gen. incert.; (Couthovia of Gray?, No. 1). A tree, forty feet high; leaves opposite, 4 inches by 2½, entire, sheathing at base; terminal corymbs; calyx minute, 5-fid; drupe elongate, contracted or stipitate at base, apiculate with the style. Ovolau." Seemann (Fl. Vit. 166. 1866) remarks that *C. Seemanni* ". . . inhabits the virgin forests of Ovalau, and has a light green foliage, and spreading, not tapering, mode of branching."

3. **Couthovia alata** sp. nov.

Frutex vel arbor corolla intus barbata excepta glabra, ramulis crassis fuscis subteretibus vel apicem versus longitudinaliter sulcatis, internodiis junioribus 1–3 cm. longis; stipulis interpetiolaribus siccitate coriaceis, apice late obtusis, inter sese et cum petiolis connatis et cupulam 5–10 mm. altam formantibus, cupula petiolorum alis conspicuis transverse ornata; petiolis validis brevibus conspicue alatis, alis 1–3 mm. latis cum eis petioli oppositi confluentibus; laminis in sicco coriaceis et plerumque viridi-olivaceis obovato-oblongis, (11–) 14–24 cm. longis, (4–) 5–12 (–16) cm. latis, basi gradatim angustatis vel subobtusis, apice obtusis, margine revolutis, costa valida utrinque prominente, nervis secundariis utrinsecus 6–10 adscendentibus leviter curvatis utrinque manifeste elevatis, rete venularum immerso vel utrinque paullo prominulo; floribus in apice ramulorum in corymbos (cymosos, cymis 3–5-plo divisis) dispositis, pedunculo primario crasso ad 3 cm. longo saepe subnullo, pedunculis secundariis 2–4 ad 7 cm. longis rectis, cymae ramulis primariis 8–30 mm. longis, pedicellis subnullis, bracteis deltoideis circiter 1 mm. longis ciliolatis; calyce papyraceo minute luteo-glanduloso cupuliformi fere ad basim 5-lobato, lobis imbricatis orbiculari-oblongis, circiter 1.5 mm. longis et 2 mm. latis, apice rotundatis, margine ciliolatis; corolla subcarnosa obscure luteo-glandulosa circiter 5 mm. longa, lobis deltoideo-oblongis, circiter 2 mm. longis et 1.5 mm. latis, apice acutis et saepe leviter incrassatis, tubo circiter 2.5 mm. diametro apice pilis rectis circiter 1.2 mm. longis barbato cetera glabro; staminibus 5 tubo insertis, filamentis gracilibus circiter 1 mm. longis, antheris oblongis glabris circiter 1.5 mm. longis; ovario ellipsoideo sub anthesi glabro, stylo inconspicuo circiter 1 mm. longo, stigmate minute subcapitato; fructibus anguste obovoideis clavatis, 15–25 mm. longis, 6–10 mm. diametro, paullo infra medium abrupte contractis, apice subacutis et mucronulatis.

Viti Levu: *Parks 20869* (Bish, TYPE, UC), May–July, 1927; Rewa: Vicinity of Suva Bay, near sea-level, *Setchell & Parks 15160* (UC) (shrub 4 m. high, in dense forest), *Meebold 17012* (Bish); Naitasiri: Vicinity of Tamavua, alt. 150 m., *Gillespie 2095* (Bish), *2433* (Bish, NY, UC); Tamavua-Sawani road, alt. 200 m., *Setchell & Parks 15086* (UC) (tree, in rain-forest).

From the available material, this species appears to be limited to the lowland forest of southeastern Viti Levu; the only good flowering specimen, designated as the type, is unfortunately without detailed data, but it doubtless comes from the same region. The cited specimens have been referred to *C. Seemanni* and *C. corynocarpa*. They agree with *C. corynocarpa* in characters of the inflorescence and fruit, but they very obviously differ in having the short petioles conspicuously winged, the wings confluent with those of the opposite petiole and forming a transverse wing across the stipule-sheath. Furthermore, the leaf-blades are proportionately narrower, stiffer, and more noticeably revolute at margins, while the secondary nerves are more definitely ascending.

4. **Couthovia macroloba** sp. nov.

Frutex 5 m. altus corolla intus barbata excepta glaber, ramulis crassis stramineis subteretibus vel apicem versus leviter angulatis, internodiis junioribus 2–4 cm. longis; stipulis interpetiolaribus coriaceis, apice truncatis vel inconspicue rotundatis, inter sese et cum petiolis connatis et cupulam 8–11 mm. altam formantibus, demum forsan longitudinaliter fissis; petiolis liberis subnullis; laminis chartaceis obovato-ellipticis, 12–20 cm. longis, (5–) 7–11 cm. latis, basi gradatim angustatis, apice obtusis vel obtuse cuspidatis, utrinque in sicco viridi-fuscis, costa valida supra subplana subtus prominente, nervis secundariis 6–8 subrectis adscendentibus supra subplanis subtus conspicue elevatis, rete venularum laxe reticulato immerso vel supra insculpto et subtus leviter prominulo; floribus in apice ramulorum in corymbos 2–4 (cymosos, cymis 3- vel 4-plo divisis) dispositis, pedunculo pri-

mario crasso brevi, pedunculis secundariis 4–6 cm. longis, cymae ramulis primariis gracilibus 1–4 cm. longis, pedicellis subnullis, bracteis minutis deltoideis circiter 0.5 mm. longis; calyce papyraceo cupuliformi profunde 5-lobato, lobis imbricatis orbiculari-oblongis, 1.5–2 mm. longis, 2–2.5 mm. latis, apice rotundatis vel obtusis, margine ciliolatis; corolla distaliter crasse carnosa 6.5–7 mm. longa, lobis oblongis, 3–4 mm. longis, 1.5–2 mm. latis, apice subacutis, tubo 3–3.5 mm. diametro apice pilis rectis 1.5–2 mm. longis dense barbato cetera glabro; staminibus 5 tubo insertis, filamentis gracilibus 1–1.5 mm. longis, antheris oblongis 1.8–2 mm. longis glabris apice mucronulatis; ovario ellipsoideo glabro sparse luteo-glanduloso, stylo circiter 1 mm. longo, stigmate minute capitato; fructibus obovoideis clavatis, 30–40 mm. longis, 10–13 mm. diametro, basim versus gradatim angustatis, apice obtusis et mucronulatis.

TAVEUNI: Borders of lake east of Somosomo, alt. 700–900 m., *Smith 917* (Bish, GH, NY, TYPE, UC, US), Jan. 8, 1934 (shrub 5 m. high, in dense forest; corolla-lobes white; anthers yellow; fruit white).

This upland species is related to *C. corynocarpa,* differing in its lack of a free petiole, its proportionately narrower and more obovate leaf-blades, its ascending secondary nerves, and its larger flowers, particularly as regards the corolla-lobes and anthers. Floral proportions in *Couthovia* appear to be quite consistent for each species, and when the corollas of *C. macroloba* and *C. corynocarpa* are compared side by side the differences are very noticeable. Duplicates of the type are deposited in several European herbaria.

5. **Couthovia macrocarpa** sp. nov.

Couthovia corynocarpa sensu A. Gray in Proc. Am. Acad. **5**: 320, quoad *Seemann 303.* 1862; A. Gray in Bonplandia **10**: 37. 1862; Seem. Fl. Vit. 165. *pl. 32.* 1866; non A. Gray, 1859.

Gaertnera pyramidalis Seem. ex A. Gray in Bonplandia **10**: 37, nomen. 1862.

Arbor ad 12 m. alta corolla intus pilosa excepta glabra, ramulis crassis fuscis juventute saepe conspicue quadrangulatis demum subteretibus inconspicue lenticellatis, internodiis junioribus plerumque 1.5–3 cm. longis; stipulis interpetiolaribus coriaceis, apice truncatis vel rotundatis, inter sese et cum petiolis connatis et cupulam 5–10 mm. altam formantibus, demum longitudinaliter fissis et caducis; petiolis crassis leviter canaliculatis 5–15 (–25) mm. longis (supra stipulas); laminis chartaceis siccitate viridi-fuscis late ellipticis, 9–15 (–20) cm. longis, 6–14 (–20) cm. latis, basi obtusis vel raro subcordatis et in petiolum decurrentibus, apice rotundatis vel late obtusis, margine planis vel inconspicue recurvatis, costa valida supra paullo elevata et saepe canaliculata subtus prominente, nervis secundariis utrinsecus 6–9 patentibus utrinque leviter elevatis, rete venularum laxe reticulato immerso vel interdum utrinque prominulo; floribus in apice ramulorum in corymbos saepe solitarios (cymosos, cymis 3- vel 4-plo divisis) dispositis, pedunculo primario crasso brevi ad 15 mm. longo, pedunculis secundariis 2–4 cm. longis, cymae ramulis primariis 7–20 mm. longis, pedicellis saepe 1–3 mm. longis bracteas deltoideas circiter 0.7 mm. longas inconspicuas gerentibus; calyce papyraceo cupuliformi profunde 5-lobato, lobis saepe subcarnosis anguste imbricatis ovato-oblongis, 1.8–2.5 mm. longis et latis, margine ciliolatis; corolla distaliter carnosa in alabastro angulata 6–6.5 mm. longa, lobis oblongo-deltoideis, circiter 4 mm. longis, 1.5–2 mm. latis, apice subacutis et saepe leviter incrassatis, tubo 2.5–3 mm. diametro apice pilis 0.5–0.7 mm. longis tomentello-barbato etiam intus pilis similibus laxis pallido-tomentello; staminibus 5 tubo insertis, filamentis gracilibus circiter 1 mm. longis, antheris crassis oblongis 1.8–2 mm. longis glabris apice obtusis; ovario ellipsoideo glabro, stylo gracili 1.5–2.5 mm. longo, stigmate capitato; fructibus maturis sublignosis elliptico-obovoideis plerumque conspicue complanatis, 30–43 mm. longis, 18–28 mm. latis, 10–18 mm. crassis, basi gradatim angustatis vel obtusis, apice rotundatis et mucronulatis.

VITI LEVU: Namosi: Vicinity of Namuamua, alt. 300 m., *Gillespie 2951* (Bish, TYPE, UC), Sept. 22, 1927 (flowers faintly fragrant, the corolla greenish white, the anthers pale yellow; fruit hard, dull creamy white; native name: *mboa*); vicinity of Namosi, alt. 400 m., *Gillespie 2590* (Bish, UC) (bushy-topped tree 12 m. high, near stream; native names: *mbo, mboloa*); Namosi Valley, *Seemann 303* (source of the name *Gaertnera pyramidalis*, GH) (native name: *mboloa;* fruit eaten by pigeons); Namosi or Naitasiri: Upper Waindina River, alt. 65 m., *MacDaniels 1038* (Bish) (tree 10 m. high, in rain-forest; fruit white; native name: *mbola*). WITHOUT DEFINITE LOCALITY: *Horne 589* (GH).

Of the cited specimens, the best flowers are present on the type collection; younger and less satisfactory flowers accompany *Gillespie 2590, Seemann 303,* and *Horne 589.* All of the flowers dissected show the characteristic lax tangled tomentum within the tube. The type collection and *MacDaniels 1038* bear good mature fruits, while *Seemann 303* has a fruit similar to that illustrated in Seem. Fl. Vit. *pl. 32.* 1866. While this fruit appears to be not fully mature, it shows the characteristic flattening and woody texture. The limited distribution of this species is noteworthy, as is also the fact that its local names have not been referred to *C. corynocarpa* or other species, as far as can be ascertained from collectors' notes. Concerning the habit of his no. *303,* Seemann (Fl. Vit. 166. 1866) remarks that the species (which he took for *C. corynocarpa*) forms ". . . pyramidal trees, with dark-green foliage . . . , and they constitute a peculiar feature in the landscape of the Namosi Valley of Viti Levu; moreover they grow quite in the open country." Whether or not the habits of *C. macrocarpa* and the true *C. corynocarpa* consistently differ must be left for future observers to ascertain.

Upon receiving Seemann's collections of *Couthovia,* Gray (in Proc. Am. Acad. **5**: 320. 1862) modified his concept to point out that he observed indications of dimorphism, or incipient difference in sex, in the flowers examined. These differences pertained to the greater or lesser development of the pubescence of the corolla-throat and the length of the filaments and style. In the numerous flowers which I have examined I have found no such noteworthy variations, the characters appearing very constant; therefore I believe that Gray's conclusions were based upon inadequate material.

6. **Couthovia pachyantha** sp. nov.

Arbor ad 8 m. alta corolla intus strigosa excepta glabra, ramulis crassis fuscis juventute plerumque complanato-quadrangulatis demum subteretibus, internodiis junioribus 1.5–3 cm. longis; stipulis interpetiolaribus coriaceis, apice truncatis vel rotundatis, inter sese et cum petiolis connatis et cupulam 5–13 mm. altam formantibus, mox caducis; petiolis crassis 5–20 mm. longis (supra stipulas) complanatis margine angulatis; laminis chartaceis vel subcoriaceis siccitate viridifuscis late ellipticis, 9–20 cm. longis, 5–18 cm. latis, basi obtusis saepe subcordatis et in petiolum decurrentibus, apice rotundatis, margine planis vel inconspicue recurvatis, costa valida supra subplana vel leviter elevata subtus prominente, nervis secundariis utrinsecus 5–10 patentibus utrinque leviter elevatis, rete venularum laxe reticulato plerumque utrinque prominulo; floribus in apice ramulorum saepe brevium et defoliatorum in corymbos plerumque solitarios (cymosos, cymis 2- vel 3-plo divisis) dispositis, pedunculo crasso 8–16 mm. longo, cymae ramis primariis 10–20 mm. longis saepe complanatis et transverse rugosis, pedicellis subnullis, bracteis subcarnosis late ovatis circiter 1 mm. longis; calyce tenuiter carnoso cupuliformi profunde 5-lobato, lobis imbricatis orbiculari-ovatis, 2.5–3 mm. longis, 3–4 mm. latis, apice rotundatis, margine ciliolatis; corolla crasse carnosa 6–7 mm. longa, lobis oblongo-deltoideis, 4–4.5 mm. longis, 2.5–3 mm. latis, apice subacutis et saepe incrassatis, tubo 4–5 mm. diametro apice pilis rectis circiter 1.3 mm. longis strigoso-barbato etiam intus pilis similibus strigoso; staminibus 5 tubo insertis, filamentis gracilibus 1.5–2 mm. longis, antheris crassis oblongis circiter

2 mm. longis glabris apice obtusis; ovario ovoideo glabro, stylo crasso 2–2.5 mm. longo, stigmate capitato; fructibus maturis sublignosis fibrosis elliptico-obovoideis subcomplanatis, 25–40 mm. longis, 20–28 mm. latis, 12–20 mm. crassis, basi gradatim angustatis vel saepe rotundatis, apice rotundatis et mucronulatis.

VANUA LEVU: Thakaundrove: Between Valanga and Valethi, Savu Savu Bay region, alt. near sea-level, *Degener & Ordonez 14125* (A, TYPE), Jan. 10, 1941 (tree 8 m. high, in sunny jungle; fruit white).

In foliage and fruit this species is scarcely distinguishable from the preceding, but I believe that the large flowers, with thick-carnose corollas and a different type of corolla-pubescence, amply characterize it. Additional collections of both species are desirable. It is noteworthy that only the mature fruits of *C. pachyantha* and *C. macrocarpa* have the characteristic shape and texture; the younger fruits are obovoid and slightly asymmetrical, although not as conspicuously clavate as those of the first four species of this treatment.

APOCYNACEAE

Catharanthus roseus (L.) G. Don, Gen. Syst. **4:** 95. 1838.

Vinca rosea L. Syst. ed. 10. 944. 1759.

Lochnera rosea Reichenb. Consp. 134. 1828; Safford in Contr. U. S. Nat. Herb. **9:** 310. 1905; Christoph. in Bishop Mus. Bull. **128:** 180. 1935; non *Lochneria* Scop. (1777).

Ammocallis rosea Small, Fl. Southeast. U. S. 936. 1903.

VANUA LEVU: Thakaundrove: Waina, Maravu, near Salt Lake, *Degener & Ordonez 14188* (A) (low shrub, naturalized in coconut plantation). KORO: Eastern slope of main ridge, alt. 100 m., *Smith 1029* (NY) (subligneous herb to 1 m. high, a weed in clearings).

This widespread plant is probably becoming commonly naturalized in Fiji; it has apparently not previously been reported from the group. It has been reported from several other Pacific groups, generally under the name *Lochnera rosea*. However, *Lochnera* Reichenb. (1828) must be considered a later homonym of *Lochneria* Scop. (Introd. 271. 1777); even though no binomial has ever been used in connection with Scopoli's genus, this is properly published and is presumably named after the same individual as *Lochnera* Reichenb.

Alyxia linearifolia sp. nov.

Frutex scandens multiramosus ubique partibus florum exceptis glaber, ramulis gracilibus fusco-cinereis juventute quadrangulatis demum subteretibus, internodiis apicem ramulorum versus 2–5 mm. longis; foliis congestis plerumque quaternatis, petiolis minutis ad 1 mm. longis, laminis chartaceis in sicco viridibus oblongo-linearibus, 2–4.5 cm. longis, 1.5–2 mm. latis, basi acutis, apice obtusis, marginibus parallelis integris et leviter revolutis, costa supra immersa vel leviter impressa subtus conspicue elevata, nervis lateralibus brevibus immersis; inflorescentiis axillaribus cymosis (1–) 4–6-floris, pedunculo 3–8 mm. longo gracili leviter angulato, bracteis subacutis anguste oblongis 0.5–0.7 mm. longis, pedicellis gracilibus leviter angulatis 1–3 mm. longis, bracteolis nullis; calyce sub anthesi 1–1.2 mm. longo, lobis erectis membranaceis subacutis oblongo-deltoideis, circiter 0.7 mm. longis et 0.5 mm. latis, margine ciliolatis; corolla submembranacea, tubo urceolato-cylindrico, 3–3.5 mm. longo, paullo supra medium circiter 1.5 mm. diametro, basim et apicem versus contracto, intus distaliter pallide villoso, lobis imbricatis orbiculari-ovatis circiter 2 mm. diametro, apice rotundatis; staminibus circiter 1 mm. infra apicem tubi insertis, filamentis glabris anguste ligulatis circiter 0.3 mm. longis, antheris oblongo-deltoideis circiter 0.7 mm. longis, apice acutis, basi leviter cordatis; disco parvo pilis pallidis circiter 0.3 mm. longis setoso; carpellis distinctis glabris ovoideis, stylo gracili 1.4–1.7 mm. longo, stig-

mate parvo capitato, ovulis in quoque carpello 4 vel 5; fructibus plerumque 1 per inflorescentiam, calyce persistente, stipite gracili circiter 2 mm. longo; drupa solitaria ellipsoidea subfalcata, 8–11 mm. longa, 6–7 mm. diametro, stylo incrassato persistente coronata, pericarpio tenui (circiter 0.5 mm. crasso) extus levi vel ruguloso intus siccitate rugoso, semine ellipsoideo circiter 7 mm. longo conspicue rugoso.

Viti Levu: R a: Vatundamu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15396* (A, type), June 2, 1941 (liana, in patch of arid forest on forehill; corolla white; native name: *vono*).

Alyxia linearifolia is characterized by its congested and very narrow leaves, its small flowers, and its long-stipitate fruits with a conspicuous persistent style. It is probably a derivative of *A. stellata* (Forst.) R. & S., but, although that

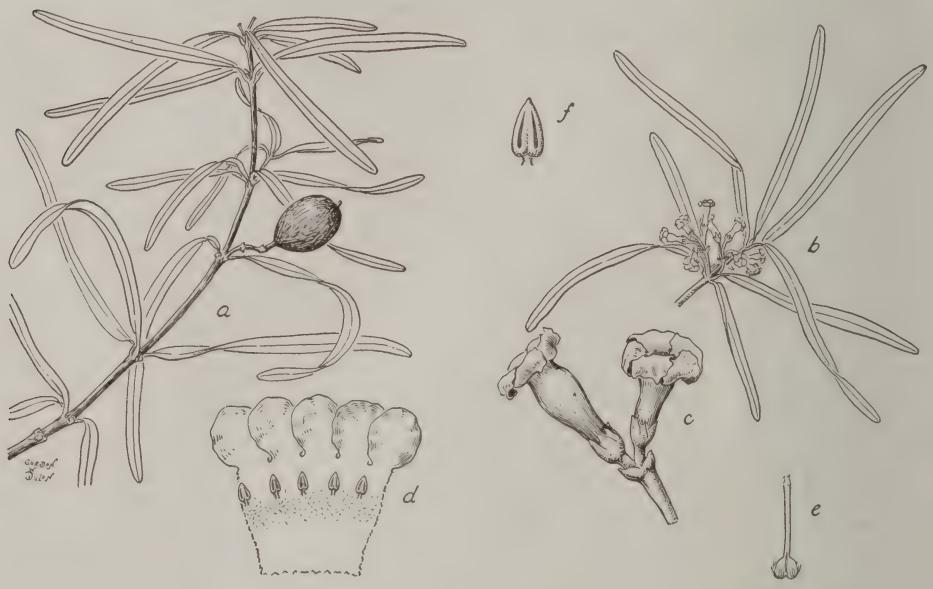

Fig. 5. *Alyxia linearifolia; a.* fruiting branchlet, × 1; *b.* flowering branchlet, × 1; *c.* flowers, × 4; *d.* opened corolla, × 4; *e.* gynaecium, × 4; *f.* stamen, × 10.

species is generally taken to be very variable, the present plant can hardly be forced into it. Possibly some of the specimens which have been referred to *A. stellata* (e.g. *Gillespie 4568* [GH] from Ovalau, with leaf-blades 3–6 mm. broad) will prove to be more closely related to *A. linearifolia.*

ASCLEPIADACEAE

Hoya R. Br.

The difficulties connected with this genus arise not so much from the lack of good specific characters as from the fact that early descriptions omitted those points which make accurate identification possible. Floral characters, especially those pertaining to the shape and pubescence of calyx-lobes, size, texture, color, and pubescence of corolla, and shape of corona-lobes, seem to be quite constant, but such characters as the length of peduncles and pedicels and their pubescence are not very reliable. Intangible foliage characters are discernible, and at least the direction of the secondary nerves appears reliable.

Five species are apparent in Fiji, only one of which, *H. australis* R. Br., has a range outside the group. Altitudinal range seems peculiarly without significance in this group, at least in Fiji, as some species are found near the sea and also toward the higher elevations in the forest. Only *H. megalantha* Turrill seems to be restricted to high elevations. As earlier descriptions are often based on inadequate material, I here redescribe four species and add a description of a fifth which appears to be new.

Key to the Fijian species

Corolla 25–45 mm. in diameter, rich pink or purple, the lobes 10–14 mm. broad, the sinuses obtuse or flattened; lobes of corona 4.5–6 mm. long, shallowly concave above; occurring at elevations of 700 m. or higher .....1. *H. megalantha.*

Corolla 11–20 mm. in diameter, the lobes 4–8 mm. broad; lobes of corona 2.5–5 mm. long.

Lobes of corona 2.5–3.5 mm. long, concave above, inconspicuously bicarinate beneath; calyx-lobes 1.5–3 mm. long, dorsally strigillose or conspicuously puberulent; corolla submembranous, white with colored center, minutely puberulent within, the sinuses acute; leaf-blades usually broadly elliptic, subcordate or rounded at base .....2. *H. australis.*

Lobes of corona 3–5 mm. long, thick, flattened above, rounded beneath; corolla conspicuously puberulent within.

Calyx-lobes deltoid-lanceolate, 3–3.5 mm. long, dorsally conspicuously strigillose; corolla subcarnose, white, the sinuses acute .....3. *H. intermedia.*

Calyx-lobes deltoid or ovate-deltoid, inconspicuous, 0.7–1.7 mm. long, glabrous except for the ciliolate margin.

Corolla subcarnose, purplish or reddish, the sinuses obtuse; secondary nerves 5–7 per side, spreading .....4. *H. vitiensis.*

Corolla submembranous, yellow, the sinuses acute; secondary nerves 3 or 4 per side, ascending, oriented from costa toward base .....5. *H. diptera.*

1. **Hoya megalantha** Turrill in Jour. Linn. Soc. Bot. **43**: 33. 1915.

Vine with slender terete glabrous or obscurely puberulent branchlets; petioles slender, rugulose, 10–16 mm. long; leaf-blades subcoriaceous to papyraceous, elliptic-ovate, 4–10 cm. long, 1.8–4 cm. broad, rounded or obtuse at base, acuminate or acute at apex, pinnate-nerved, the costa slightly impressed above, subprominent beneath, the secondary nerves 4 or 5 per side, inconspicuous, spreading, anastomosing toward margins, slightly impressed or prominulous above, prominulous beneath, the veinlet-reticulation immersed or prominulous on both surfaces; inflorescences axillary, umbellate, glabrous throughout except corolla, the peduncle slender, 25–33 mm. long, swollen and ellipsoid-capitulate at apex, the bracts minute, scariose-margined; flowers 5–20 per inflorescence, the pedicels slender, 28–35 mm. long; calyx-lobes membranous, ovate-deltoid, 1.5–2.5 mm. long, 1.3–1.8 mm. broad, obtuse at apex, glabrous except at the sometimes ciliolate margin; corolla subcarnose, rotate or broadly cyathiform, copiously but faintly reticulate-veined, rich pink or deep purple, 25–45 mm. in diameter, very minutely and densely papillose-puberulent within, the lobes broadly deltoid, 7–13 mm. long, 10–14 mm. broad, acute at apex, the sinuses obtuse or flattened; lobes of corona thick, oblong, 4.5–6 mm. long, 2–3.5 mm. broad, obtuse at apex, cuspidate or acuminate at base, shallowly concave above, rounded and deeply sulcate beneath; pollinia 0.8–1.2 mm. long; carpels glabrous.

Vanua Levu: Mbua: Navotuvotu, summit of Mt. Seatura, alt. 700–830 m., *Smith 1649* (Bish, NY) (vine, in crest thickets; corolla rich pink). Taveuni: Borders of lake east of Somosomo, alt. 700–900 m., *Smith 863* (Bish, NY) (vine, in dense forest; sepals purple; corolla rich pink; native name: *ndraumbimbi*); trail above Somosomo, alt. 750 m., *Gillespie 4815* (Bish).

The species was originally described from specimens collected by im Thurn on Mt. Victoria, Tholo North, Viti Levu, and Mt. Mbuke Levu, Kandavu. Al-

though I have not seen these, the cited material is referred to the species with confidence, agreeing precisely with the earlier description. It is noteworthy that *H. megalantha* has thus far been collected only in four widely separated montane areas. Although having no foliage features which distinguish it from such species as *H. vitiensis*, *H. megalantha* is very distinct on the basis of floral characters mentioned in the key.

2. **Hoya australis** R. Br. ex Traill in Trans. Hort. Soc. **7:** 28. 1827; Gibbs in Jour. Linn. Soc. Bot. **39:** 157. 1909; Turrill in Jour. Linn. Soc. Bot. **43:** 33. 1915.

Hoya bicarinata A. Gray in Proc. Am. Acad. **5:** 335. 1862; in Bonplandia **10:** 37. 1862; Seem. Fl. Vit. 163. 1866.

Hoya Billardieri sensu Seem. ex A. Gray in Bonplandia **10:** 37, as synonym. 1862; non Decaisne.

Vine with terete and glabrous or sparingly puberulent branchlets; petioles rugulose, puberulent or glabrous, 6–22 mm. long; leaf-blades chartaceous or subcarnose, glabrous, broadly elliptic or oblong or suborbicular, (3–) 5–13 cm. long, 3–8 cm. broad, subcordate or rounded at base, short-acuminate or cuspidate at apex, pinnate-nerved, the costa nearly plane or slightly canaliculate above, subprominent beneath, the secondary nerves 4–6 per side, spreading, anastomosing toward margins, prominulous on both surfaces, the veinlet-reticulation prominulous on both surfaces or immersed; inflorescences axillary, umbellate, the peduncle stout, 4–30 mm. long, glabrous or puberulent, ellipsoid-capitulate at apex, the bracts inconspicuous; flowers 20–35 per umbel at anthesis, the pedicels slender, puberulent, 12–40 mm. long; calyx-lobes oblong-deltoid or lanceolate-oblong, 1.5–3 mm. long, 0.8–2 mm. broad, subacute at apex, dorsally strigillose or conspicuously puberulent; corolla submembranous, 13–17 mm. in diameter, white, purplish or reddish at base within, densely but minutely puberulent within, the lobes deltoid, 6–7 mm. long, 4–5.5 mm. broad, the sinuses acute; lobes of corona ovoid, 2.5–3.5 mm. long, 1.8–2 mm. broad, obtuse at apex, acuminate at base, concave above, inconspicuously bicarinate beneath; pollinia 0.6–0.8 mm. long; carpels usually pale-puberulent, sometimes apparently glabrous; fruits linear, about 14 cm. long and 7 mm. broad, striate and usually puberulent at maturity.

WAYA, Yasawa Group: Nangua, alt. 330–460 m., *St. John 18100* (A, Bish) (vine on trees at edge of cliff; corolla white; native name: *nambetiambete*), *St. John 18164* (A, Bish) (vine over bushes, in woods; flowers fragrant, the corolla white with purplish center). VITI LEVU: Tholo North: Slopes of Mt. Victoria, alt. 1200 m., *Gillespie 4096.1* (Bish); Namosi: Wooded hills east of Namosi, alt. 475 m., *Gillespie 2523* (Bish, NY, UC); slopes of Mt. Voma, alt. 500 m., *Gillespie 2494* (Bish) (native name: *wa tambua*). KANDAVU: Namalata Isthmus region, near sea-level, *Smith 4* (Bish, NY) (vine, on edge of mangrove swamp; corolla white; native name: *mbitimbiti*). TAVEUNI: Vicinity of Waiyevo, alt. 600 m., *Gillespie 4747* (Bish) (in woods above coconut plantations). VANUA MBALAVU: Southern limestone section, near sea-level, *Smith 1460* (Bish, NY) (vine, on sea-cliff; corolla white). SOVU, near Vanua Mbalavu: *Bryan 590* (Bish) (vine, climbing over rocks and trees in forest; flowers very fragrant; corolla white and deep red, alt. 5–60 m.). FULANGA: *Smith 1214* (Bish, GH, NY, UC, US) (vine, on limestone cliff in lagoon; corolla white, rich purple at base; corona white; native name: *mbitambita*). WITHOUT DEFINITE LOCALITY: *Seemann 319* (GH); *U. S. Expl. Exped.* (US).

As represented by the cited specimens, the present species is very coherent, being readily distinguished by its elongate strigillose calyx-lobes, its concave corona-lobes, and its thin corollas which are only minutely puberulent within. Among Fijian species it is further distinguished by its comparatively broad leaf-blades which are usually subcordate at base. The above description is taken only from the Fijian specimens and may require amplification when the species as a whole is considered.

Hoya pilosa Seem. (ex A. Gray in Bonplandia **10**: 37, nomen. 1862; Seem. Fl. Vit. 163, nomen. 1866; Britten in Jour. Bot. **36**: 417, 418, nomen. 1898), which has never been adequately described, is founded on *Seemann 321,* a sterile duplicate of which is at GH. It has been referred to *H. australis* (or *H. bicarinata*), but its leaf-blades are pilose beneath and I am dubious of its place here. In shape and texture of leaf-blades it suggests the following new species, but because of its pubescence it cannot definitely be placed there.

In referring the cited Fijian specimens to *H. australis,* I am following the majority of authors who have worked on this group. Bentham (Fl. Austral. **4**: 346. 1868) apparently had no doubt that *H. bicarinata* and *H. australis* were synonyms, and his description fits the Pacific specimens fairly well. Britten (in Jour. Bot. **36**: 414. 1898) also places *H. bicarinata* in synonymy, remarking that *Asclepias volubilis* Forst. (Fl. Ins. Austr. Prodr. 21, excl. syn. 1786), from the New Hebrides, is also the same species. This position is followed by Setchell (in Carn. Inst. Publ. **341**: 57. 1924) and several other authors and is generally accepted in herbaria.

Christophersen (in Bishop Mus. Bull. **128**: 188. 1935) expresses the opinion that *H. bicarinata* may be upheld for the Samoan specimens, at least for the time. Basing his concept of *H. australis* upon Bentham's description, Christophersen points out several respects in which the Samoan material differs; these characters concern the degree of pubescence of the young stem, the proportions of the peduncle and the pedicels and their pubescence, and the color and pubescence of the corolla. On the basis of a series of material from Samoa, Tonga, Fiji, and the New Hebrides, I am convinced that characters concerning the length and degree of pubescence of the peduncle and pedicels are of little consequence. Specimens with adequate notes, from these regions, are said to have the corolla purple to red or reddish brown at base within, while the inner surface is densely and obviously puberulent. Australian specimens, on the other hand, are said to have the corolla pink-tinged at the base within, while its inner surface is glabrous, according to Bentham. However, the Australian specimens which are available to me show that the corolla is obscurely but densely puberulent. As to its color, it seems probable that the notes on Bentham's specimens were not very complete, and one may question the validity of this character.

In short, on the basis of Australian and Pacific material now available to me, I find no reliable characters on which the specimens can be divided into *H. australis* on the one hand and *H. bicarinata* on the other. Future observations and monographic work on the genus may modify this opinion.

3. **Hoya intermedia** sp. nov.

Liana, ramis crassis teretibus glabris vel apicem versus pallide puberulis, ramulis lateralibus brevibus 1–5 cm. longis dense foliatis; petiolis crassis (circiter 3 mm. diametro) in sicco valde rugosis 10–20 mm. longis; laminis carnosis oblongis, 8–12 cm. longis, 2–4.5 cm. latis, basi obtusis, apice subacutis, pinnatinerviis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 5–7 adscendentibus saepe immersis interdum utrinque prominulis, rete venularum immerso interdum utrinque prominulo; inflorescentiis axillaribus umbellatis, pedunculo crasso 10–15 mm. longo dense pallido-puberulo glabrescente, apice ellipsoideo-capitulato interdum elongato-verrucoso; bracteis deltoideis circiter 1 mm. longis acutis puberulis; floribus sub anthesi 12–25 per inflorescentiam, pedicellis gracilibus 17–30 mm. longis strigillosis (pilis albidis circiter 0.5 mm. longis); calycis lobis membranaceis deltoideo-lanceolatis, 3–3.5 mm. longis, 1.8–2 mm. latis, dorso

conspicue strigillosis; corolla subcarnosa rotata 16–17 mm. diametro intus copiose et conspicue sericeo-puberula, lobis deltoideis 6–7 mm. longis et latis, apice acutis et saepe recurvatis, sinibus acutis; coronae lobis crassis oblongis, 4.5–5 mm. longis, 2–2.5 mm latis, apice obtusis, basi acutis vel cuspidatis, supra complanatis, subtus rotundatis et profunde sulcatis; polliniis circiter 0.7 mm. longis; carpellis glabris.

VANUA LEVU: Thakaundrove: Valethi, Savu Savu Bay region, alt. 10 m., *Smith 399* (Bish, GH, NY, TYPE, UC, US) (vine, in thickets; corolla white; corona pink-tinged; native name: *ndraumbimbi*).

In its elongate strigillose calyx-lobes, *H. intermedia* resembles *H. australis,* while in characters of its corolla and corona it seems more closely related to *H. vitiensis.* The new species is further distinguished from both of its allies by its habit, having short lateral foliaceous branchlets, its stout petioles, proportionately narrower leaf-blades, and larger bracts.

4. **Hoya vitiensis** Turrill in Jour. Linn. Soc. Bot. **43**: 34. 1915.

Vine with slender terete glabrous branchlets; petioles stout, shallowly canaliculate, 5–19 mm. long; leaf-blades carnose or chartaceous, elliptic-ovate or oblong-elliptic, 6–11 cm. long, (1.5–) 3–7 cm. broad, rounded or obtuse or subcordate at base, acuminate or cuspidate at apex, pinnate-nerved, the costa slightly impressed or elevated above, subprominent beneath, the secondary nerves 5–7 per side, spreading, anastomosing toward margins, slightly raised on both surfaces, the veinlet-reticulation prominulous on both surfaces or sometimes immersed; inflorescences axillary, umbellate, glabrous throughout except corolla, the peduncle slender, 30–55 mm. long, ellipsoid-capitulate at apex and occasionally verrucose for the distal 15 mm., the bracts minute; flowers 12–20 per umbel at anthesis, the pedicels slender, 22–40 mm. long; calyx-lobes membranous, inconspicuous, ovate-deltoid, 1–1.7 mm. long, 1.2–1.5 mm. broad, obtuse at apex, glabrous except at the ciliolate margin; corolla subcarnose, 16–20 mm. in diameter, copiously and conspicuously sericeo-puberulent within, the lobes deltoid, 5–7 mm. long, 6–8 mm. broad, often recurved at margin, the sinuses obtuse; lobes of corona thick, oblong, 4–5 mm. long, 1.5–2.7 mm. broad, obtuse at apex, acuminate at base, flattened above, rounded and deeply sulcate beneath; pollinia 0.6–1 mm. long; carpels glabrous; fruits about 3 per mature inflorescence, the calyx persistent, the carpel linear, 16–21 cm. long, 7–9 mm. in diameter, striate when dried, glabrous.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, alt. 750–1000 m., *Parks 20732* (Bish, UC) (vine, on trees in forest; flowers maroon or waxy-purple-white), *Degener 14304* (A) (vine, in forest; corolla pale purplish red, velvety; corona pale claret); Mt. Matomba, near Nandarivatu, alt. 750–900 m., *Degener 14627a* (A) (native name: *wandra;* used for garlands); Namosi: Vicinity of Namosi, alt. 450 m., *Gillespie 2599* (Bish) (native name: *wa tambua ndamundamu*); Mt. Naitarandamu, alt. 900 m., *Gillespie 3095* (Bish); Rewa: Vicinity of Suva, alt. 150 m., *Gillespie 2180* (Bish, UC) (in woods); Naitasiri: Mt. Korombamba, southeastern slopes, alt. 300 m., *Gillespie 2305* (Bish, UC). WITHOUT DEFINITE LOCALITY: *Horne* (GH).

Although I have not seen the type, collected at Nandarivatu by im Thurn, the original description leaves no doubt as to identification of the species. Noteworthy characters are found in the densely pubescent thick corolla, the lobes of which are separated by obtuse sinuses, the inconspicuous calyx-lobes, and the spreading secondary nerves of the leaf-blades. Specimens with adequate notes apparently have the corollas richly colored, a character which contrasts with such species as *H. australis, H. intermedia,* and *H. diptera.*

The identity of *H. Barracki* Horne (A Year in Fiji, 263, nomen. 1881) is dubious, although Baker (in Jour. Linn. Soc. Bot. **20**: 369. 1883) refers it to *H.*

australis. If the above-cited Horne specimen at GH represents a duplicate of *H. Barracki*, the name should be referred to *H. vitiensis*.

5. **Hoya diptera** Seem. ex A. Gray in Proc. Am. Acad. **5:** 336, nomen. 1862; A. Gray in Bonplandia **10:** 37, nomen. 1862; Seem. Fl. Vit. 163. 1866; Turrill in Jour. Linn. Soc. Bot. **43:** 33. 1915.

Vine with slender glabrous or distally puberulent branchlets, sometimes the branchlets short, lateral, densely foliaceous; petioles rugulose, 5–15 mm. long, pale puberulent or glabrous; leaf-blades subcarnose, elliptic or ovate-elliptic or narrowly oblong, 3.5–8 cm. long, (1–) 2–3.2 cm. broad, obtuse at base, cuspidate or obtusely short-acuminate at apex, pinnate-nerved, the costa slightly impressed or plane above, subprominent beneath, the secondary nerves 3 or 4 per side, ascending, oriented from costa toward base, prominulous on both surfaces or submersed, the veinlet-reticulation immersed; inflorescences axillary, umbellate, the peduncle 10–45 mm. long, glabrous or obscurely puberulent, ellipsoid-capitulate at apex, sometimes verrucose for the distal 5 mm., the bracts inconspicuous; flowers 5–10 per umbel at anthesis, the pedicels slender, 8–20 mm. long, glabrous or sparsely pale puberulent; calyx-lobes membranous, inconspicuous, deltoid, 0.7–1.1 mm. long and broad, glabrous except at the ciliolate margin; corolla submembranous, 11–16 mm. in diameter, yellow, copiously and conspicuously puberulent within, the lobes deltoid or ovate-deltoid, 4–6 mm. long and broad, often recurved at margin, the sinuses acute; lobes of corona thick, oblong, 3–4.2 mm. long, 1.6–1.8 mm. broad, obtuse at apex, acuminate at base, flattened above, rounded beneath; pollinia 0.5–0.6 mm. long; carpels glabrous.

Viti Levu: Tholo North: Nauwanga, near Nandarivatu, alt. about 750 m., *Degener 14333* (A) (vine, in open forest; corolla yellow, reddish toward center), *Degener 14755* (A) (liana, in forest; corolla yellow); Naitasiri: Vicinity of Nasinu, alt. 150 m., *Gillespie 3556* (Bish, UC) (liana with pendent inflorescences, in woods). Vanua Levu: Thakaundrove: Savuthuru Mt., near Valethi, alt. 90 m., *Degener & Ordonez 13832* (A) (vine, in forest; corolla yellow); Vatunivuamonde Mt., alt. 240 m., *Degener & Ordonez 14014* (A) (vine, in open forest; corolla yellow). Without definite locality: *Seemann 320* (type coll., GH) (Viti Levu and Taveuni); *U. S. Expl. Exped.* (US).

As represented by the cited specimens, this species is characterized by inconspicuous calyx-lobes, a comparatively thin corolla which is yellow and perhaps reddish tinged at base within, and by the ascending secondary nerves of its leaf-blades. The cited type duplicate does not show the flattened subalate peduncles mentioned by Seemann, and I am inclined to believe that this character, apparently the source of the specific name, was due merely to the degree of pressing of the actual type. In foliage the type duplicate is an excellent match for the other cited specimens.

CONVOLVULACEAE

Merremia nymphaeifolia (Bl.) Hall. f. in Versl. 'S Lands Plantent. **1895:** 127. 1896; Reinecke in Bot. Jahrb. **25:** 671. 1898.

Kandavu: Namalata Isthmus region, alt. 0–30 m., *Smith 191* (GH, NY) (vine, in thickets; corolla white).

This species, which Reinecke reports from Samoa, is here first mentioned from Fiji; the determination is by Dr. S. J. van Ooststroom.

Operculina Turpethum (L.) S. Manso, Enum. Subst. Braz. 16. 1836; Christoph. in Bishop Mus. Bull. **154:** 39. 1938.

Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15404* (A) (weed in garden and along roadsides, uncommon; native name: *wa ndamundamu*).

This species, mentioned from Samoa by Christophersen, has not previously been reported from Fiji.

Quamoclit pennata (Desr.) Boj. Hort. Maurit. 224, as *Q. pinnata*. 1837; Voigt, Hort. Suburb. Calcut. 353. 1845.

VANUA MBALAVU: Central volcanic section, near Lomaloma, alt. 100–200 m., *Smith 1421* (GH, NY) (vine; corolla bright red; weed in clearings).

This tropical American plant, now widely naturalized, has not previously been reported from Fiji. The genus is thus far unreported from the group.

Quamoclit coccinea (L.) Moench, var. **hederifolia** (L.) House in Ann. N. Y. Acad. Sci. **18:** 262. 1908.

VITI LEVU: Tholo West: Viro, near Saru, *Tabualewa 15615* (GH).

This widely naturalized plant has apparently not previously been reported from Fiji or nearby groups.

VERBENACEAE

By H. N. MOLDENKE

Lantana Camara L. var. **aculeata** (L.) Moldenke in Torreya **34:** 9. 1934.

Lantana aculeata L. Sp. Pl. 627. 1753.

VITI LEVU: Tholo North: Nandala, vicinity of Nandarivatu, alt. about 750 m., *Degener 15026* (A, NY) (shrub about 3 m. high; native name: *tokalau*). VANUA LEVU: Thakaundrove: Hills south of Nakula Valley, alt. 10–30 m., *Smith 341* (NY) (subscandent shrub 1–4 m. high, common; corolla white to pink; fruit black; native name: *waiwai*).

From our records it appears that neither the species nor the variety has previously been recorded from Fiji in taxonomic literature, although the latter is abundantly naturalized there. The Degener collection has the involucral bractlets remarkably large and conspicuous, somewhat approaching those seen in the material now passing as *L. Moritziana* Otto & Dietr. from tropical America.

Stachytarpheta mutabilis (Jacq.) Vahl, Enum. **1:** 209. 1804.

VITI LEVU: Nandi: Vicinity of Nandi, *Degener 15327* (A, NY) (common in a large field; flowers red); Tholo North: Vicinity of Nandarivatu, alt. 900 m., *Gillespie 4418* (NY).

The species has not previously been reported from Fiji.

Stachytarpheta urticaefolia (Salisb.) Sims in Curtis, Bot. Mag. **43:** *pl. 1848*, as *S. urticifolia*. 1816.

Cymburus urticaefolius Salisb. Parad. Lond. *pl. 53*. 1806.

VITI LEVU: Rewa: Suva, *Meebold 8161* (NY), *Degener & Ordonez 13505* (A, NY) (roadside weed, to 1 m. high; corolla dark purplish blue). KANDAVU: Namalata Isthmus region, near sea-level, *Smith 11* (NY) (herb to 1 m. high, a weed in clearing; corolla deep blue; native name: *tumbutumbu*). VANUA LEVU: Thakaundrove: Maravu, near Salt Lake, near sea-level, *Degener & Ordonez 14212* (A, NY) (naturalized in coconut grove; corolla dark blue).

This widespread weed has not previously been reported from Fiji under the above name, having been widely confused with *S. indica* (L.) Vahl and *S. jamaicensis* (L.) Vahl.

Premna taitensis Schau. var. **marchionica** F. H. Br. in Bishop Mus. Bull. **130:** 248, as *P. tahitensis* var. *m.* 1935.

VITI LEVU: Ra: Nanukuloa, *Degener & Ordonez 13674* (A); near coast on Viti Levu Bay, *Degener & Ordonez 13693* (A).

These collections are the first of the variety to be recorded from Fiji; it was originally reported from the Marquesas and Tuamotus.

Premna taitensis Schau. var. **rimatarensis** F. H. Br. in Bishop Mus. Bull. **130:** 248, as *P. tahitensis* var. *r.* 1935.

VITI LEVU: Lautoka: North of Lomolomo, *Degener & Ordonez 13641* (A, NY) (large tree, in a ravine in small jagged hills); Tholo North: Korovou, east of Tavua, alt. 60–150 m., *Degener 14949* (A, NY) (tree, in isolated dry forested ravine). OVALAU: Near Levuka, alt. 30 m., *Degener & Ordonez 13793* (A, NY) (tree 5 m. high, in shrubby pasture; native name: *rauvula*). VANUA LEVU: Thakaundrove: Maravu, near Salt Lake, *Degener & Ordonez 14183* (A, NY) (tree, in forest; timber used in house-building; native names: *yaro, tavotavo*).

The variety, originally described from the Austral Islands, is here first recorded from Fiji.

Vitex quinata (Lour.) F. N. Will. in Bull. Herb. Boiss. II. **5**: 431. 1905.

Vitex heterophylla Roxb. Hort. Beng. 46, hyponym. 1814.

VITI LEVU: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. about 750 m., *Degener 14481* (A, NY) (small tree, in forest; native name: *mbo*).

The cited specimen is the first of the species known from Fiji.

Vitex trifolia L. var. **bicolor** (Willd.) Moldenke, Known Geogr. Distr. Verb. 79. 1942.

Vitex bicolor Willd. Enum. Hort. Berol. 660. 1809.

Vitex Negundo L. var. *bicolor* H. J. Lam, Verb. Malay. Arch. 191. 1919.

VITI LEVU: Ra: Shore of Viti Levu Bay, *Degener & Ordonez 13691* (A, NY) (shrub); Serua: Ngaloa, near shore, *Degener & Ordonez 13620* (A, NY) (shrub about 1.5 m. high). MAKONDRONGA: *Degener & Ordonez 13815* (A) (shrub 2 m. high, on coast). KANDAVU: Western end of island, near Cape Washington, *Smith 314* (GH, NY) (spreading tree 4 m. high, on sandy coast; corolla deep blue, paler without; native name: *ndrala*). VANUA LEVU: Thakaundrove: Maravu, near Salt Lake, *Degener & Ordonez 14058* (A, NY) (shrub 1–2 m. high, on strand; corolla blue). FULANGA: *Smith 1200* (NY) (tree 10 m. high, on beach; corolla blue; native name: *ndrala*).

I cannot agree with Dr. Lam that the closest affinity of this plant is with the Indian *V. Negundo* L. It always grows in a habitat similar to that of *V. trifolia* L. and, indeed, often in close association with the typical form of this species (with three leaflets) and the unifoliolate form (*V. trifolia* var. *simplicifolia* Cham.). Its inflorescence characters all point unmistakably to a very close affinity with *V. trifolia,* rather than with *V. Negundo.* The confusion has doubtless arisen from the fact that many Asiatic specimens of *V. trifolia* and its varieties have been identified as *V. Negundo* in herbaria.

Clerodendrum fragrans (Vent.) R. Br. var. **pleniflorum** Schau. in DC. Prodr. **11**: 666, as *Clerodendron fragrans β pleniflora.* 1847; Lam, Verb. Malay. Arch. 260, as *Clerodendron flagrans* var. *pleniflora.* 1919.

VITI LEVU: Ra: Nanukuloa, *Degener & Ordonez 13672* (A) (shrub, along roadside).

This appears to be the first record from Fiji of either the species or the variety.

Clerodendrum speciosissimum Van Geert ex Morren in Hort. Belg. **3**: 322. *pl. 68,* as *Clerodendron s.* 1836; Paxt. in Mag. Bot. **3**: 217, 271. 1837.

Clerodendron fallax Lindl. in Bot. Reg. **30**: 19. 1844.

VITI LEVU: Lautoka: North of Natalau, alt. 30 m., *Degener 14987* (A, NY) (shrub, naturalized in dry rocky forest); Tholo West: Mbelo, near Vatukarasa, alt. 150 m., *Degener 15168* (A) (shrub, sparingly naturalized in pasture among guavas). KANDAVU: Namalata Isthmus region, near sea-level, *Smith 188* (NY) (herb 1 m. high; floral parts bright red; in clearing).

This species has not previously been recorded from Fiji.

LABIATAE

Pogostemon Cablin (Blanco) Benth. in DC. Prodr. **12**: 156. 1848.

VITI LEVU: Tholo West: Vatukarasa, alt. 120–300 m., *Degener 15326* (A) (leaves used to scent coconut oil; native name: *tukilamlam*). VANUA LEVU: Thakaundrove:

Vatunivuamonde Mt., Savu Savu Bay region, alt. about 400 m., *Degener & Ordonez 14018* (A) (sprawling shrub to 1 m. high, in clearing near summit).

Pogostemon Cablin appears not to have been previously reported from this part of the Pacific; it is apparently becoming naturalized in Fiji.

SCROPHULARIACEAE

Limnophila rugosa (Roth) Merr. Interpret. Herb. Amb. 466. 1917.

Vanua Levu: Thakaundrove: Valanga, Savu Savu Bay region, alt. 30 m., *Degener & Ordonez 13910* (GH) (subprostrate, in springy clearing; flowers pale blue).

Although the species has not previously been reported from Fiji under this name, Hemsley (in Rep. Voy. Challenger 1(3): 243. 1885) implies that *Seemann 352* (cited as *Adenosma triflora* (Roxb.) Nees in Seem. Fl. Vit. 185. 1866) is identical with *Limnophila Roxburghii* G. Don, a synonym of *L. rugosa*.

GESNERIACEAE

Cyrtandra tomentosa sp. nov.

Frutex, ramulis crassis rectis subteretibus apicem versus pilis castaneis multiseptatis ad 4 mm. longis densissime strigoso-tomentosis demum glabrescentibus cinereis striatis; foliis oppositis, petiolis crassis ad 4.5 cm. longis ut ramulis pilosis, laminis papyraceis oblongo-lanceolatis, 15–23 cm. longis, 2.5–5.5 cm. latis, basi gradatim attenuatis et in petiolum decurrentibus, apice angustatis et acuminatis, margine dentibus curvatis callosis 1–4 per centimetrum inconspicue serratis vel basim versus integris, supra minute scrobiculatis et pilis castaneis ad 3 mm. longis multiseptatis basi bulbosis hispidis demum glabrescentibus et scabris, subtus pilis tenuioribus brevioribus ferrugineis densissime et persistenter tomentosis et costa hispidis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 9–12 arcuato-adscendentibus supra subplanis subtus paullo elevatis, rete venularum immerso vel subtus leviter prominulo; inflorescentiis axillaribus cymosis congestis ut videtur 3- vel 4-floris, pedunculo subnullo, bracteis paucis parvis deltoideo-oblongis ad 4 mm. longis setosis; pedicellis 1–5 mm. longis cum calyce dense fulvo-strigoso-tomentellis (pilis multiseptatis 2–4 mm. longis); calyce sub fructu juvenili papyraceo campanulato circiter 10 mm. longo pilis pallidis multiseptatis circiter 4 mm. longis basi intus dense sericeo-strigoso, lobis 5 subaequalibus attenuatis deltoideo-lanceolatis 4–5 mm. longis; disco tenuiter carnoso breviter tubuloso circiter 1 mm. alto integro; gynaecio glabro, ovario ellipsoideo, stylo circiter 6 mm. longo, stigmate capitato circiter 1.5 mm. diametro; fructibus juvenilibus ad 10 mm. longis et 6 mm. latis ellipsoideis apicem versus angustatis, pericarpio ruguloso circiter 0.7 mm. crasso, calyce ut videtur persistente.

Viti Levu: Tholo North: Nandrau, vicinity of Nandarivatu, alt. about 600 m., *Degener 14889* (A, type), Mar. 26, 1941 (shrub, in forest; native name: *mbeta*).

A member of the Section *Campanulaceae, C. tomentosa* bears a close resemblance in its pubescence to *C. Chippendalei* Horne, but differs in its oblong-lanceolate and much narrower leaf-blades, which are long-attenuate rather than cuneate or obtuse at base, and its somewhat shorter pedicels and calyx, the latter with proportionately longer and narrower lobes.

Cyrtandra Aloisiana sp. nov.

Frutex circiter 1 m. altus, ramulis gracilibus juventute pilis multiseptatis 2–4 mm. longis densissime ferrugineo-villosis demum glabris cinereis obscure quadrangularibus; foliis oppositis, petiolis gracilibus 1.5–3 cm. longis leviter canaliculatis ut ramulis villosis glabrescentibus, laminis papyraceis elliptico-oblongis, 10–21 cm. longis, 4–8 cm. latis, basi attenuatis et in petiolum decurrentibus, apice subacutis vel gradatim acuminatis, margine inconspicue serratis (dentibus 1–4 per

centimetrum mucronulatis), supra sparse hispidis (pilis circiter 2 mm. longis basi bulbosis), subtus praecipue costa nervisque longe ferrugineo-pilosis, costa supra subplana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 6–8 adscendentibus supra planis vel insculptis subtus leviter elevatis, venulis subtus prominulis; inflorescentiis cymosis axillaribus, pedunculo 3–6 (sub fructu ad 15) mm. longo pilis ferrugineis patentibus multiseptatis 1.5–2 mm. longis dense villoso; bracteis exterioribus 2 papyraceis lanceolato-ovatis, 15–17 mm. longis, 6–7 mm. latis, longe acuminatis, utrinque ut pedunculo dense villosis, bracteis interioribus pluribus submembranaceis ovatis, 7–8 mm. longis, 4–5 mm. latis, acuminatis, utrinque sericeo-villosis; floribus 4–8 per inflorescentiam congestis, pedicellis gracilibus sub anthesi 5–6 mm. sub fructu ad 12 mm. longis ut pedunculo villosis; calyce submembranaceo 7–9 mm. longo fere ad basim 5-lobato, lobis lanceolatis, 5–7 mm. longis, circiter 2 mm. latis, acuminatis, extus ut bracteis pilosis, intus glabris; corolla membranacea cylindrica, sub anthesi 15–16 mm. longa, circiter 4 mm. diametro, extus glabra vel distaliter sparse pilosa, intus glabra, lobis 5 aequalibus suborbiculari-ovatis circiter 4 mm. diametro rotundatis; staminibus fauce insertis glabris, filamentis filiformibus circiter 2 mm. longis, antheris deltoideo-oblongis, 1.5–2.5 mm. longis, apice mucronulatis, basi cordatis; disco subcarnoso annulari glabro circiter 0.7 mm. alto; gynaecio glabro; ovario ellipsoideo, stylo gracili ad 5 mm. longo, stigmate capitato circiter 2 mm. diametro; fructibus juvenilibus anguste oblongo-ellipsoideis apicem versus angustatis, calyce demum deciduo.

Viti Levu: Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15619* (A); Serua: Thulanuku, vicinity of Ngaloa, near sea-level, *Degener 15105* (A, type), Apr. 29, 1941 (shrub about 1 m. high, on wet forested slope near ocean; corolla yellowish; stems used medicinally; native name: *makamakandora*).

A species of the Section *Polynesieae, C. Aloisiana* seems most closely related to *C. anthropophagorum* Seem., with which it agrees fairly well in foliage, differing in its more compact and short-pedunculate inflorescence, short pedicels, and essentially glabrous rather than villose corollas. The new species has the pubescence of the young parts and the nerves of the lower surfaces of leaf-blades conspicuously longer.

At Mr. Degener's suggestion, the species is named for Aloisio Tabualewa, a Fijian collector who was of great assistance to him, especially in the Serua region.

ACANTHACEAE

Thunbergia grandiflora Roxb. Hort. Beng. 45. 1814; Fl. Ind. ed. 2. **3**: 34. 1832.

Viti Levu: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15493* (A) (sparingly persistent on low land).

This native of India, previously unreported from the islands near Fiji, is apparently becoming naturalized.

Dyschoriste repanda (A. Gray) comb. nov.

Chaetacanthus repandus A. Gray in Proc. Am. Acad. **5**: 349, excl. syn. 1862; Seem. Fl. Vit. 185. 1866.

Calophanes repandus Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 257. 1892; Gillespie in Bishop Mus. Bull. **91**: 27. *f.* 30. 1932.

Viti Levu: Tholo West: Viro, near Saru, *Tabualewa 15616* (A) (low shrub). Ovalau: *U. S. Expl. Exped.* (GH, type coll.), *Graeffe* (GH). Vanua Levu: Thakaundrove: Southern slope of Valanga Range, alt. 200–400 m., *Smith 388* (GH, NY) (shrub 1 m. high, in dense forest; corolla white); between Valanga and Urata, Savu Savu Bay region, near sea-level, *Degener & Ordonez 13861* (A) (shrub 1 m. high, in rocky forest; corolla white). Without definite locality: *Horne 238* (GH).

Although the corolla-lobes are scarcely contorted, the flowers of our species nevertheless agree with those of many other species which fall into Lindau's concept (in E. & P. Nat. Pfl. IV. **3b**: 302. 1895) of *Dyschoriste* Nees. The generic name has not previously been noted in the literature pertaining to Fijian plants.

Graptophyllum insularum (A. Gray) comb. nov.

Eranthemum insularum A. Gray in Proc. Am. Acad. **5**: 349. 1862; in Bonplandia **10**: 37. 1862; Seem. Fl. Vit. 186. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 257. 1892; Hemsl. in Jour. Linn. Soc. Bot. **30**: 187. 1894.

Graptophyllum siphonostena F. v. Muell. Fragm. Phyt. Austr. **6**: 87, nomen. 1868; Hemsl. in Jour. Linn. Soc. Bot. **30**: 187, nomen. 1894; Stapf ex Hemsl. in Jour. Linn. Soc. Bot. **30**: 214. 1894; Lindau in E. & P. Nat. Pfl. IV. **3b**: 327. 1895; Burkill in Jour. Linn. Soc. Bot. **35**: 49. 1901; Gibbs in Jour. Linn. Soc. Bot. **39**: 159. 1909.

VITI LEVU: Lautoka: North of Lomolomo, alt. 60 m., *Degener & Ordonez 13724* (A) (shrub 1 m. high, on shaded ledge; corolla pale purplish pink); north of Natalau, alt. 60 m., *Degener 14999* (A) (shrub to 3 m. high, in dry rocky forest; corolla red); Tholo North: Vicinity of Nandarivatu, alt. 600–900 m., *Degener & Ordonez 13562* (A) (tree 3 m. high, in rain-forest; corolla dark red), *Degener 14823* (A) (tree 4 m. high, in open forest; corolla purplish red), *Degener 14896* (A) (in forest; leaves bronzed beneath); Rewa: Visari R., *Prince* (GH). OVALAU: *Seemann 351*, in part (GH, type coll. of *G. siphonostena*). KANDAVU: Namalata Isthmus region, near sea-level, *Smith 44* (GH, NY) (shrub 8 m. high, in low forest; fruit green). VANUA LEVU: Thakaundrove-Mathuata boundary: Korotini Range, alt. 650–900 m., *Smith 562* (GH, NY) (tree 5 m. high, in dry forest; corolla rich pink); Thakaundrove: Maravu, near Salt Lake, alt. 90 m., *Degener & Ordonez 14202* (A) (scraggly shrub 1 m. high, on forested slope; corolla red). FULANGA: *Smith 1120* (GH, NY) (slender shrub 1 m. high, in forest on limestone formation, alt. 0–80 m.; corolla rich pink). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (GH, TYPE COLL.).

TONGA: "Vavau and Lifuka," *Harvey* (GH).

There seems no doubt that the two synonyms cited above refer to the same concept. Although both Mueller and Stapf, in their discussions of *Graptophyllum siphonostena*, cite the Seemann collection without number, they doubtless had part of his number *351*. Under this number, as Gray noted (in Bonplandia **10**: 37. 1862), Seemann had combined his specimens of the present species and *Eranthemum laxiflorum* [= *Pseuderanthemum laxiflorum* (A. Gray) Hubbard]. That Mueller's name does not refer to the latter species is obvious from Stapf's description and his citation of the Harvey specimen from Tonga. This same Tongan collection was cited in Gray's original description of *Eranthemum insularum*. The species clearly falls into *Graptophyllum* Nees in Lindau's system.

RUBIACEAE

By F. R. Fosberg

Dolicholobium A. Gray

The Fijian species of *Dolicholobium* are not especially well understood and are not separated by very clear distinguishing characters. Four species have been described, of which *D. Macgregori* Horne seems to be the most distinct, but chiefly on the basis of the much greater size of all of its parts. It may, however, have to be associated with *D. latifolium* A. Gray when the latter is better known. *D. latifolium* has apparently not been found since the original collection, and cannot be satisfactorily treated at present. It seems to differ chiefly in leaf-shape from *D. oblongifolium* A. Gray. From this latter species *D. longissimum* Seem. differs principally in the spreading rather than appressed pubescence. These two I would associate as varieties, along with a third variety described to

accommodate much of what has been referred to *D. oblongifolium*, but which differs somewhat from the type. An arrangement of these varieties is given below under *D. oblongifolium*, the oldest name. Varying characters, in addition to those on which the varieties are founded, occur in the length of the fruit and in the pistillate calyx, which in certain specimens is somewhat lobed. These correlate with nothing else and are, at least for the present, disregarded.

Dolicholobium oblongifolium A. Gray in Proc. Am. Acad. **4**: 309. 1860.

This species must be considered the type of the genus, since Gray says that flowering specimens of it collected by Milne afforded the materials necessary for characterizing the genus.

Dolicholobium oblongifolium var. **oblongifolium** (A. Gray) Fosberg, nom. nov.
Dolicholobium oblongifolium A. Gray, l. c. (*s. str.*).

Leaves thin, 12–17 cm. long, obovate-oblanceolate, acuminate at apex, cuneate at base, the midrib, petioles, stipules, inflorescence and fruit loosely appressed- or subappressed-pilose.

VANUA LEVU: Mbua: Sandalwood Bay, *U. S. Expl. Exped.* (US, TYPE). TAVEUNI: *Gillespie 4721* (US, NY).

I have seen three other U. S. Exploring Expedition sheets (1 GH, 2 NY) which are identical with the one cited above, but which are without locality. The National Herbarium sheet is designated as the type, since it has a definite locality and is more complete.

Dolicholobium oblongifolium var. **Degeneri** Fosberg, var. nov.

Folia crassa chartacea, basi obtusa, vix strigosa.

Leaves short, obovate or oblong, the apex scarcely acuminate, the base obtuse, the pubescence thin, strigose, the veins 10 or 11 on a side.

VANUA LEVU: Mbua: Navotuvotu, summit of Mt. Seatura, alt. 700–830 m., Apr. 27, 1934, *Smith 1643* (GH, NY, US, TYPE). Other collections, which it seems unnecessary to cite in detail, are as follows: VITI LEVU: *Gillespie 2017, 4225, 2559* (all US), *3618, 4284, 2646, 3618, 3614* (all NY); *Degener 14423, 14747, 14816* (all USNA, A); *Degener & Ordonez 13769* (USNA, A); *Tabualewa 15590* (USNA, A). VANUA LEVU: *Smith 1573, 1871* (both GH, NY, US). KORO: *Smith 1053* (GH, NY, US), approaching var. *oblongifolium*. WITHOUT LOCALITY: *Horne 518, 868* (both GH).

Dolicholobium oblongifolium var. **longissimum** (Seem.) Fosberg, comb. nov.
Dolicholobium longissimum Seem. in Bonplandia **9**: 256, nomen. 1861; Fl. Vit. 121. *pl. 25.* 1866.

Leaves obovate, slightly acuminate, the veins usually 10 or 11 per side, the pubescence dense, rusty, velutinous-tomentose.

VITI LEVU: *Seemann 215* (GH, TYPE COLL.). VANUA LEVU: Thakaundrove: Mt. Mariko, alt. 600–866 m., *Smith 426* (GH, NY, US).

Gillespie 3488 (NY), from Vanua Levu, with stipules obovate rather than oblong and with veins 12–14 per side, must also belong here.

NEONAUCLEA Merr.

Neonauclea Forsteri (Seem.) Merr. in Jour. Wash. Acad. **5**: 540. 1915.
Nauclea Forsteri Seem. Fl. Vit. 121. 1866.
Neonauclea vitiensis Gillespie in Bishop Mus. Bull. **74**: 28. 1930.

VITI LEVU: Tholo North: Near Nandarivatu, *Gillespie 4188* (NY, isotype of *N. vitiensis*); Tholo West: Naruku, vicinity of Mbelo, near Vatukarasa, alt. 120–300 m., *Degener 15232* (USNA, A); Uluvatu, same general locality, *Degener 15312* (USNA, A); Tholo East: Wainimala Valley, south of Matawailevu, *St. John 18375* (Bish).

I can now see no essential difference between *N. vitiensis* and *N. Forsteri.* When I noted the St. John collection as *N. vitiensis* (in Bull. Torrey Club **67**: 419. 1940) I thought that the Fijian plant had thicker and differently shaped leaves, but the cited Degener collections completely break down these differences. The supposed pedicels to which I referred in that publication are merely the persistent axes of the fruits. *N. vitiensis,* when originally published, was not compared with *N. Forsteri,* but *Sarcocephalus pacificus* Rein. was mentioned as congeneric. The latter is now referred to the genus *Sarcopygme.*

Randia [Houst.] L.

Randia [Houst.] L. Sp. Pl. 1192. 1753; Gen. Pl. ed. 5. 74. 1754.

Pelagodendron Seem. Fl. Vit. 124. 1866.

Canthiopsis Seem. Fl. Vit. 166. 1866.

The two monotypic genera, *Pelagodendron* and *Canthiopsis,* described by Seemann in Flora Vitiensis in Rubiaceae and Loganiaceae respectively, seem to be identical. Examination of an isotype of *Pelagodendron vitiense, Seemann 240* (NY), shows that it belongs to the same species as his *Canthiopsis odorata,* which has long since been transferred to *Randia,* where it certainly belongs. Specimens which have been referred to *Pelagodendron* have somewhat larger leaves, but are otherwise identical with *Randia odorata.* The separation of these into different families by Seemann was apparently due to faulty observation of the ovary and ovules of *Canthiopsis,* as otherwise his descriptions of the two do not differ significantly. His illustration shows an almost superior ovary with one ovule in a cell. Bentham and Hooker, Drake, Gillespie, and A. C. Smith have all agreed in referring *Canthiopsis* to *Randia.* Of these at least Bentham and Hooker and Smith had access to the type. Smith also compared his *no. 1438* with the type of *Pelagodendron vitiense* and noted that it does not differ essentially. The sheet of *Seemann 240* at New York is labelled "Randia? teste Seem.," showing that Seemann was aware that at least fruiting material showed a resemblance to *Randia.* On this sheet there is a condensed inflorescence having the appearance of a "witches' broom," which may have been what Seemann meant in his description by "floribus axillaribus fasciculatis." This looks to me like an abnormal inflorescence.

Randia vitiensis (Seem.) Fosberg, comb. nov.

Pelagodendron vitiense Seem. Fl. Vit. 124. April 2, 1866.

Canthiopsis odorata Seem. Fl. Vit. 166. Oct. 1, 1866.

Randia odorata B. & H. ex Drake, Ill. Fl. Ins. Mar. Pac. 191. 1890.

Viti Levu: Serua: Vicinity of Ngaloa, alt. 0–150 m., *Degener 15186* (USNA, A); Naitasiri: Korombamba Mt., *Gillespie 2220* (NY, US); Tamavua woods, *Gillespie 2019* (NY, US). Ovalau: *Seemann 240* (NY, isotype). Vanua Levu: Thakaundrove: Yanawai River region, *Smith 1832* (NY, US), *Degener & Ordonez 14118* (USNA, A). Vanua Mbalavu: Malatta islet, *Smith 1438* (NY).

Since the fascicle in which *Pelagodendron* is published is dated earlier than that in which *Canthiopsis* appeared, the epithet *vitiensis* must take precedence.

Dorisia Gillespie

Dorisia flavida (Seem.) A. C. Sm. in Bishop Mus. Bull. **141**: 140. 1936.

Viti Levu: Tholo North: Nandarivatu, alt. 800–900 m., *Degener & Ordonez 13579* (USNA, A).

This collection extends the range of the species to Viti Levu. It has been previously reported from Rambi and Vanua Levu, where, judging by the number of collections, it must be rather common.

This species shows considerable variation. The Degener specimen is glabrous, has small, ovate to broadly elliptic coriaceous leaves, with the veins close together and prominently reticulate. Smith's specimens from Vanua Levu (nos. *430, 1790, 1932*) have the leaves larger, thinner, elliptic to narrowly obovate, with less prominent veins, and are all perfectly glabrous. Another specimen from Vanua Levu (Mbua: between Mbua and Devoka, *Mrs. H. B. R. Parham III* [A]), with large leaves similar to those of the Smith material, has the under surface of the leaves, the branchlets, the midrib of the stipules, and the inflorescence closely papillate-hirtellous. The fruits of this fragmentary specimen are rather small, but not significantly different. When better material of this plant is available it may well prove to be a distinct species, or at least a variety.

Timonius DC.

Timonius affinis var. **sapotaefolius** (A. Gray) Fosberg, comb. nov.

Timonius sapotaefolius A. Gray in Proc. Am. Acad. **4**: 35. 1860.

Differs from *T. affinis* A. Gray only in the less prominent and more numerous secondary veins, and in the more prominent areolation between them.

Without definite locality: *U. S. Expl. Exped.* (US, type, GH).

Two sheets, both sterile, but probably belonging here, from Samoa (Savaii: Tuata, *Reinecke 388* [US]), have the stems more fleshy and the leaves larger than on the type.

The sheet at Washington is designated as the type, as the one at Gray is only a fragment with drawings.

Timonius Smithii Fosberg, sp. nov.

Arbor subglabra; folia late elliptica acuta petiolata; stipulae strigosae; cymae masculae graciles dichotomae pauciflorae secundae; fructus solitarius pedunculatus subcompressus, 10-costatus, apice vix retusus tenuiter carnosus, pyrenis 7, rectis, in putamen oblongum connatis.

Tree up to 18 m. tall, essentially glabrous, or the young parts somewhat strigose, the bark of branchlets gray; leaf-blades broadly elliptic, acute or acutish at both ends, up to 14 cm. long and 7 cm. wide, with 5–7 veins on a side; petioles up to 2 cm. long; stipules 3–4 mm. long, ovate-triangular, ventricose, free, strigose, ciliate at margin, persistent on only 1 or 2 nodes from the apex of branchlet; staminate cymes axillary, slender, thinly appressed-tomentulose or puberulent, the peduncle 13–25 mm. long, once dichotomous, the branches 5–10 mm. long, the cyme with 1 terminal flower and 3–5 on each branch, these secund, subsessile, subtended by vestigial bracts; calyx subtruncate or very shallowly lobed, thinly tomentose; corolla densely tomentulose externally, especially below, "whitish," only buds available, the longest of these about 5 mm.; pistillode glabrous, 2 mm. long; pistillate flowers unavailable, probably solitary; fruiting peduncles 1–3.5 cm. long, with a single fruit subtended by two minute bracts; fruit red, thinly carnose, cylindro-ellipsoid, slightly compressed, 1.5–2.5 cm. long, 1.2–1.8 cm. wide, rounded at both ends, slightly retuse at apex around the persistent cup-shaped calyx, this about 1 mm. high and 2 mm. wide, subtruncate to shallowly and irregularly 6-lobed; pyrenes straight, about 7, fused into an oblong, somewhat compressed, shallowly ribbed stone, the ribs about 10, the sclerification in two layers, the outer of firmly packed coherent granules, with a number of more or less open longitudinal cavities, the inner, surrounding the cells, hard and bony, the cells circular in transverse section, arranged in 2 parallel rows.

VITI LEVU: Naitasiri: Suva Pumping Station, alt. 30–80 m., *Degener & Ordonez 13760* (USNA, A) (leaves smaller than type). VANUA LEVU: Thakaundrove: Natewa Bay region, hills west of Korotasere, alt. 100–300 m., *Smith 1930* (GH, NY, US); Mbua: Lower Wainunu River Valley, alt. 0–200 m., *Smith 1724* (GH, NY, US) (leaves smaller and with less veins than type). MOALA: Forest above Maloku, alt. 400 m., Mar. 22, 1934, *Smith 1347* (GH, NY, US, TYPE).

This species is close to the plant known as *Guettarda Kajewskii* Guillaumin of the New Hebrides, which has not been transferred to *Timonius,* but of which a discussion is to be published elsewhere. *T. Smithii* differs in its few-flowered once-dichotomous cymes, and in its fruit, which is fewer-celled and rounded at both ends, with the pyrenes more firmly united.

MORINDA L.

The Fijian species of *Morinda* have been rather puzzling to me, and, judging from misidentifications in herbaria, also to others. In connection with identification of the Degener collections of this genus I have had occasion to study rather carefully not only what material I could get of the Fijian species of the genus, but of related plants from the Indo-Pacific area. While no treatment for this area is yet attempted, certain observations on the Fijian members may be recorded. The widespread *M. citrifolia,* common in Fiji as well as the whole Indo-Pacific region, is omitted from the discussion.

Morinda Grayi Seem. Fl. Vit. 130. 1866.

Morinda lucida A. Gray in Proc. Am. Acad. **4**: 41. 1860; not Benth. (1849).

VITI LEVU: Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, alt. 120–300 m., *Degener 15261* (USNA, A); Serua: Vatutavathe, vicinity of Ngaloa, alt. 0–150 m., *Degener 15197* (USNA, A); Thulanuku, vicinity of Ngaloa, alt. 0–150 m., *Degener 15116* (USNA, A). VANUA LEVU: Thakaundrove: Hills south of Nakula Valley, alt. 40 m., *Smith 348* (GH, NY, US); Mbua: Southern portion of Seatovo Range, alt. 100–350 m., *Smith 1521* (GH, NY, US). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (US, TYPE, GH), *Seemann 223* (GH).

This species seems amply distinct and rather uniform. It is a liana most easily recognized by its large, ovate, acuminate, usually curved, glossy leaves, conspicuously pointed buds, and large fruits, about 2 cm. across. It is known from a number of collections from both Vanua Levu and Viti Levu. The type specimens at Washington and at Gray Herbarium are practically identical, and have no locality other than "Feejee Islands." The U. S. National Herbarium sheet contains more ample material and bears the original dissections, and so it is here designated as the type. Since the original material was in fruit only, a description of the flowering heads is presented here.

Heads borne 2 or 3 (rarely 4) at the terminal nodes of short lateral branchlets, on peduncles about 1 cm. long (rarely much longer), the peduncles sometimes shortly united at base, the heads glabrous, 10–20-flowered; buds acute; calyx a fleshy truncate cup; corolla 6–8 mm. long, divided halfway to base into 5 (rarely 4) reflexed lobes, glabrous externally, exceedingly woolly internally, "pale orange" or "white within, yellow without"; anthers linear, just less than 2 mm. long.

Morinda umbellata L. Sp. Pl. 176. 1753.

This species is known, in its typical form, from Ceylon, and probably from much of southeastern Asia. In southeastern Asia, the Malayan region, and New Guinea, it breaks up into a number of closely related species or varieties, whose interrelationships have not been well worked out. The problem presented is similar to that of a number of other vast, variable species, whose subdivisions are

mostly too closely related to merit specific rank but have commonly been described as species on the basis of a few scattered specimens. A final disposition of these, in the Indo-Pacific area, must await a great amount of further collecting and field study. Several Pacific forms in this complex, most of which have been considered species in the past, are dealt with below. With the exception of *M. mollis* A. Gray, they are considered to be varieties of *M. umbellata* L., as the differences are rather slight, mostly of degree, and tend to break down when a large series of specimens is examined. I have not seen material of *M. nandarivatensis* Gillespie, but it is of this relationship.

Morinda umbellata var. **Forsteri** (Seem.) Fosberg, comb. nov.

Morinda Forsteri Seem. Fl. Vit. 129. 1866.

Morinda myrtifolia A. Gray in Proc. Am. Acad. **4**: 41. 1860.

This is distinguishable from Asiatic material chiefly by its somewhat thicker, glabrous, less venulose leaves with veins anastomosing somewhat farther from the margins, larger flowers, often glabrous or almost so within, and purple fruits. It is almost indistinguishable from *M. umbellata* var. *glandulosa* (Merr.) Fosberg of Guam, but has somewhat smaller flowers, glabrous, or at least less woolly within. *M. myrtifolia* A. Gray is apparently only a rather narrow-leaved form of this. The corolla-tubes on the sheet of the type collection (*U. S. Expl. Exped.*) at Washington are rather shorter than usual for the variety. I do not think that it is worth recognition, at least until further collections demonstrate some correlation of the differences.

This variety is found from Pitcairn and Henderson Islands as far west as the New Hebrides, and perhaps to New Caledonia. I am transferring the epithet *Forsteri* to *M. umbellata* rather than the earlier *myrtifolia,* as the former is well known and there is no doubt as to its application, while the latter still has a somewhat doubtful status.

Morinda umbellata var. **bucidaefolia** (A. Gray) Fosberg, comb. nov.

Morinda bucidaefolia A. Gray in Proc. Am. Acad. **4**: 41. 1860.

This plant has been distinguished chiefly by its obovate, usually cuneate, coriaceous, strongly reticulate leaves, and slender, somewhat funnelform corollas. The variety described below is intermediate between this and *M. umbellata* in its vegetative characters and has flowers similar to those of *M. bucidaefolia.* Since in Asiatic material corollas may frequently be found almost as slender as in these plants, and since the slenderness is largely due to a somewhat longer corolla tube, an extremely unstable character in this group, the reduction to varietal status seems justified.

VANUA LEVU: Thakaundrove: Natewa Peninsula, Uluingala, alt. 600–820 m., *Smith 1999* (GH, NY, US); Mbua: Sandalwood Bay, *U. S. Expl. Exped.* (GH, US, TYPE).

I think that the two U. S. Exploring Expedition specimens are without doubt from the same collection, and the Washington specimen, being the more ample, is designated as the type.

Morinda umbellata var. **Archboldiana** Fosberg, var. nov.

Folia chartacea vix reticulata basi rotundata.

This variety differs from var. *bucidaefolia,* to which it is closest, in its usually larger chartaceous leaves which are up to 12 cm. long and 6.5 cm. wide, more rounded at base, and less prominently reticulate.

Viti Levu: Serua: Thulanuku, vicinity of Ngaloa, Apr. 29, 1941, alt. 30 m., *Degener 15115* (USNA, type, A); Naitasiri: Woods near road beyond Tamavua Village, 7 miles from Suva, alt. 150 m., *Gillespie 2194* (NY); Tholo North: Nauwanga, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14814* (USNA, A); Nandarivatu, alt. 800–900 m., *Degener & Ordonez 13535* (USNA, A), *Greenwood 850* (USNA, A).

The Greenwood specimen represents a delicate small-leaved form which may merit further study when additional collections are available.

Morinda mollis A. Gray in Proc. Am. Acad. **4**: 41. 1860.

This liana, with all parts except the old stems densely and finely pubescent, and with membranous sharply acuminate leaves, presenting a very characteristic appearance, is closely allied to *M. umbellata*, but for the present is maintained as a species. No intermediates are known, and judging by the few collections available, the species is very uniform. It is known only from Viti Levu and Ovalau (*fide* Seemann). The type, *U. S. Expl. Exped.* (US), is without a definite locality.

Ixora L.

Ixora Sect. **Vitixora** Fosberg, sect. nov.

Cyma capitata terminalis, foliis 2 suffulta; bractae lobique calycis lineares.

Shrubs or small trees, the young internodes decussately flattened, their edges rounded; leaves shortly petiolate to subsessile; stipules forming a short tube or sheath, but with lobes drawn out into long aristae; inflorescence sessile between a terminal pair of leaves (rarely between smaller axillary ones), a strongly congested head-like cyme with linear or filiform bracts crowded among the flowers; calyx-lobes linear or lanceolate; corolla with lobes only slightly sinistrorse in bud, oblong, obtuse, reflexed at anthesis; anthers on short filaments inserted in the sinuses, attached near base, linear-sagittate; style filiform, exceeding corolla-tube, the stigma fusiform, bifid, the lobes coherent at first, later divergent and reflexed; fruit fleshy, globose.

This group is, so far as known, confined to the Fiji Islands. It is probably closest to Sect. *Phylleilema* A. Gray, from which it differs in the character of the leaves subtending the heads (in *Vitixora* similar to foliage leaves, in *Phylleilema* broad and usually cordate), in the presence of linear bracts among the more closely crowded flowers of the larger heads, and in the elongate linear calyx-lobes.

Vitixora seems coordinate with what are regarded by Bremekamp as subgenera. To me *Ixora* seems such a coherent group, in spite of its size, that it may not readily be divided into convincing subgenera. The natural groups of species within the genus are mainly separated by characters of the inflorescence, with few other differences that correlate with these. In flower and fruit structure there is a striking uniformity. Therefore I regard the major species-groups at present as sections.

Four species of Sect. *Vitixora* are known (*I. Storckii* Seem., which I have not seen, may go here, but is too briefly described to be placed); they may be separated by the following key:

Leaves glabrous beneath.
- Leaves subsessile, with about 16–18 pairs of prominent veins, the calyx-lobes and bracts 4–5 mm. long (Vanua Levu) ..... *I. coronata* A. C. Sm.
- Leaves shortly petioled, with 12–14 pairs of inconspicuous veins, the bracts filiform, the calyx-lobes ligulate (Viti Levu, vicinity of Nandarivatu) ... *I. amplexicaulis* Gillespie.

Leaves shortly pubescent beneath.
- Leaves cordate at base (Viti Levu, Kandavu) ..... *I. pelagica* Seem.
- Leaves cuneate or acute at base (Vanua Levu, Taveuni) ..... *I. somosomaensis* Gillespie.

ABRAMSIA Gillespie

Abramsia trichotoma Gillespie in Bishop Mus. Bull. **91**: 29. 1932.

VANUA LEVU: Mathuata: Wainunu-Ndreketi divide, alt. 200–300 m., *Smith 1849* (GH, NY, US); Thakaundrove: Vatunivuamonde Mt., Savu Savu Bay region, alt. 300 m., *Degener & Ordonez 13964* (USNA, A). TAVEUNI: Western slope between Somosomo and Wairiki, alt. 600–830 m., *Smith 796* (GH, NY, US).

This species has heretofore been reported only from Viti Levu. *Smith 1849* has the corolla-tube several times the length of the lobes, which is much longer than that of other flowering material known.

PSYCHOTRIA L.

Psychotria L. Syst. ed. 10. 929. 1759.

Calycodendron A. C. Sm. in Bishop Mus. Bull. **141**: 154. 1936.

Eumorphanthus A. C. Sm. in Bishop Mus. Bull. **141**: 157. 1936.

The genus *Psychotria* is one of the most complex and difficult of all the groups of flowering plants in Fiji, and for that matter, in the whole Indo-Pacific area. In the Degener collection most of the previously described valid species are represented, as well as eight new ones, to which are added three new ones collected by Smith. There is little doubt that some of the described species will run together when more thorough collecting has been done and all of the types examined. Also, some of the supposedly endemic Fijian ones may prove to be identical with unsuspected ones from other island groups. At present, I would not attempt a revision, even of the Fijian ones, without an opportunity to study them in the field.

A number of presumably natural groups within the genus are apparent, some of which have been described as separate genera. Several of these may be confined to Fiji, while others are more widespread. It does not seem possible to determine the category to which they belong from the material available of the species known. The plants of the other parts of Melanesia will have to enter into any such evaluation, and especially those of New Guinea. Consequently, I am not assigning any definite status to the groups here reduced to *Psychotria*.

Calycodendron and *Eumorphanthus* are both chiefly characterized by an enlarged showy calyx and peculiar corolla forms. The types of corolla involved in these genera are to be found in *Psychotria*, except that they are there much smaller, and not usually associated with a particularly showy calyx. The corolla of *P. vitiensis* Fosberg (*Calycosia monticola* Gillespie) is certainly not significantly different from that of *Calycodendron*, and both the corolla and fruit of *P. confertiloba* A. C. Sm. are scarcely significantly different from those of *Eumorphanthus fragrans*. The tendency toward an enlarged, membranous, showy calyx is manifest in various species of *Psychotria* in Fiji (cf. *P. carnea, P. calycosa, P. macrocalyx, P. neurocalyx, P. St.-johnii*, etc.), and the groups that have been set off principally on this character seem to me to be merely the culminations of some of these lines of development, and, as such, cannot, in my opinion, be maintained as genera, although they may represent closely related groups of species. When a comprehensive knowledge of this vast genus is acquired, it may well be found that some of the entire lines of evolution within it are not properly associated together, and that they will have to be separated, but so far I see no basis for this. At present I think that *Calycodendron* and *Eumorphanthus* (including *Psychotria confertiloba* A. C. Sm.) represent natural

species-groups within the genus *Psychotria,* to which I cannot, as yet, assign a definite rank.

Another such group, which may well be connected with *Eumorphanthus,* is that described as the subgenus *Piptilema* A. Gray. This seems to represent an important evolutionary plexus among the Fijian species of the genus, although it probably does not merit the rank of subgenus. Of the characters assigned to it by Gray, "stipulae squamaceae" does not apply, as the stipules seem to be of the calyptrate type, ordinarily with forked free apices, common to the majority of *Psychotria* species of Fiji and Polynesia; "caducissimae" is correct; "flores sessiles, capitellati, ebracteolati" is true only of some of the species that must go here. "Capitulo terminali primum bracteis squamaceis caducis involucrato" refers, of course, to the habit, common to the species with the type of stipules mentioned above, of bearing the inflorescences at the terminal node, surrounded by a pair of enlarged stipules which are shed as the inflorescences develop.

The description of the pyrenes and seeds is the part that seems to characterize a group of related species, including those referred by Gray to his subgenus. The fruit of this group is, in gross appearance, ovoid, oval, or even rotund, but dries to a very characteristic form, broad and compressed basally, then abruptly contracted, even hastate, with the distal portion prolonged, with a ridge or keel on each face. The pyrenes are broad, thin, and hastate basally, abruptly narrowed above, then gradually narrowed to a subtruncate or toothed apex. The dorsal faces have a prominent keel or wing, at least on the apical part, sometimes extending to the base. In some species there are subsidiary keels beside the main central one. Other modifications are introduced by interruptions in the keels, especially in the secondary ones. I do not know, as yet, what the relationship of similar species with the keels on the pyrenes arranged differently is to this group, whether one of derivation or merely evolution from similar ancestors. The nucleus of the group is composed of *P. Pickeringii, P. monocarpa, P. aurantiocarpa, P. cordata, P. platycocca, P. taviunensis, P. griseifolia,* and, perhaps, *P. filipes.* These species are variable, especially *P. Pickeringii* (cf. Gillespie in Bishop Mus. Bull. **74**: 34. 1930), and seem to intergrade in various directions. Only extensive collections and much careful field study will clarify their interrelationships and their connections with other species and species-groups. I suspect that *P. neurocalyx* and *P. furcans* may be related here, and that if *P. furcans* is correctly so interpreted, then also probably *P. edentata* and *P. pachyantha,* of which the fruits are not known. *P. Caldwellii* seems obviously close to this group, but has the lateral flat parts of the pyrenes prolonged almost to the apex.

Psychotria pubiflora (A. Gray) Fosberg, comb. nov.
Calycosia pubiflora A. Gray in Proc. Am. Acad. **4**: 306. 1860.
Calycodendron pubiflorum A. C. Sm. in Bishop Mus. Bull. **141**: 155. 1936.

Psychotria magnifica (Gillespie) Fosberg, comb. nov.
Calycosia magnifica Gillespie in Bishop Mus. Bull. **74**: 39. 1930.
Calycodendron magnificum A. C. Sm. in Bishop Mus. Bull. **141**: 156. 1936.

Psychotria glabra (Turrill) Fosberg, comb. nov.
Calycosia glabra Turrill in Jour. Linn. Soc. Bot. **43**: 26. 1915.
Calycodendron glabrum A. C. Sm. in Bishop Mus. Bull. **141**: 155. 1936.

Psychotria fragrans (Gillespie) Fosberg, comb. nov.
Calycosia fragrans Gillespie in Bishop Mus. Bull. **74**: 38. 1930.
Calycodendron fragrans A. C. Sm. in Bishop Mus. Bull. **141**: 155. 1936.

Psychotria rufocalyx Fosberg, nom. nov.

Calycodendron rufescens A. C. Sm. in Bishop Mus. Bull. **141**: 156. 1936; not *Psychotria rufescens* H. B. K.

Psychotria Gibbsiae var. **velutina** Fosberg, var. nov.

Planta velutino-pilosa; cyma compacta.

Differs from *Psychotria Gibbsiae* Moore in the more compact inflorescence with thicker branches and very short pedicels, and in having the young parts, petioles, cymes, hypanthia, and calyces velutinous-pilose, with the undersides of the leaves sparsely so.

Viti Levu: Tholo West: Mbuyombuyo, near Namboutini, June 18, 1941, *Tabualewa 15605* (USNA, type, A).

The specimen is rather inadequate, but this disposition of it seems correct.

Psychotria Eumorphanthus Fosberg, nom. nov.

Eumorphanthus fragrans A. C. Sm. in Bishop Mus. Bull. **141**: 158. 1936; not *Psychotria fragrans* (Gillespie) Fosberg.

Psychotria vitiensis Fosberg, nom. nov.

Psychotria vitiensis Seem. in Bonplandia **9**: 257, nomen. 1861; Fl. Vit. 136, as synonym. 1866.

Calycosia monticola Gillespie in Bishop Mus. Bull. **74**: 39. *f. 55.* 1930; not *Psychotria monticola* Hiern in Oliv. Fl. Trop. Afr. **3**: 199. 1877.

Although this species has been reduced to *P. calycosa* A. Gray by Gray, Seemann, and A. C. Smith, I am of the opinion that it is distinct. It differs from the type of that species in size and texture of leaves, size of cyme, and especially in the calyx, which is fusiform, not sharply distinct from the hypanthium, contracted somewhat above, then flaring at apex, rather than broadly campanulate and abruptly dilated above the hypanthium. It is very well illustrated by Gillespie.

Since Seemann's name was published first as a nomen nudum, then in synonymy, and Gillespie's specific epithet is preoccupied in *Psychotria, P. vitiensis* must be regarded as a new name, starting with the present publication.

Psychotria calycosa A. Gray in Proc. Am. Acad. **4**: 45. 1860.

I have studied three sheets of the U. S. Exploring Expedition material that formed the basis of this species, as well as three that Gray subsequently referred to it and quite a number that have been so identified by subsequent workers. Of the three original sheets, only the one at the U. S. National Herbarium is in such a state of preservation as to be readily identifiable. It is here designated as the type. It is from Ovalau. The following description is drawn from it.

Glabrous; leaves oblong-oblanceolate, the blades 7–9 cm. long, 2–3 cm. wide, somewhat acuminate at apex, contracted to an acute base, chartaceous, with 9–11 rather spreading secondary veins on a side, which anastomose near the margin, the petiole 6–10 mm. long; well developed stipules not available; cyme solitary at terminal node, but with a small bud beside it which suggests that it will become lateral, the peduncle 2.5 cm. long, pentachotomous, the branches about 12 mm. long, each 2–3-branched at apex, the branchlets short, bearing single flowers or clusters of 3 flowers on pedicels 2–3 mm. long (if the sheets at NY and GH belong here, the branching of the inflorescence is somewhat variable); calyces campanulate, about 3.5 mm. long, 5–6 mm. wide, deeply 4-lobed, the lobes ovate, rounded, somewhat 3–5-nerved, spreading to reflexed; corolla in bud only, glabrous externally except that the sutures are somewhat hirtellous, the whole at least 12 mm. long, the tube membranous, glabrous within, the throat and lobes thickened and densely woolly within, the wool longest in throat, the anthers at-

tached basally on short filaments, with 2 basal lobes projecting well below the attachment, inserted well below the sinuses; style filiform, glabrous, somewhat bifid and fleshy at apex; fruits not available; some buds not yet full-sized tending to open when dried.

The Gray Herbarium sheet seems substantially the same thing, but the cyme is only trichotomous, and the calyces are rather poorly developed, with the lobes tending to be unequal and the buds more hirtellous along the sutures.

The New York sheet has two twigs, one much like those described above, but with little left of the cyme, the other a different looking plant, too young to be identified with certainty at present.

All other material that I have seen referred to this species either belongs somewhere else or is not in condition to be positively identified. The three sheets that Gray referred here subsequent to his original description belong to *P. vitiensis* Fosberg.

Psychotria platycocca A. Gray in Proc. Am. Acad. **4**: 47. 1860.

This species seems not uncommon, judging by the number of collections, but most of the material that has in the past been referred here seems to belong elsewhere. As apparent from an examination of the original material (*U. S. Expl. Exped.*, US, GH), the species is glabrous, with obovate, subacuminate, cuneate, chartaceous leaves, which are variable in size but rather small, slender trichotomous cymes bearing on each branch a cluster of about 3 sessile or subsessile flowers, ovoid fruits with broad, flat, subhastate pyrenes, widest near base, and with a high thin dorsal keel in the distal two-thirds.

Of the two sheets of the type material seen, the U. S. National Herbarium sheet is definitely from Ovalau, while the Gray sheet is merely labeled "Feejee Islands," the former is more ample and has, in addition to immature flowering cymes, dissections of fruits. Therefore the U. S. sheet is designated as the type. It represents an unusually large-leaved robust form. The species is also known from Viti Levu (*Degener 14900, 14678, 14395, Gillespie 4093, 3184*) and from Vanua Levu (*Degener 14241*).

The species is highly variable, even with the completely discrepant material excluded, approaching *P. filipes* through plants with slender cymes (*Degener 14900*) and *P. Pickeringii* var. *solanoides* through specimens with very short, poorly developed cymes (*Degener 14395*). Plants from Ovalau have the leaf-bases cuneate, *Degener 14241* from Vanua Levu has them subcordate, and the material from Viti Levu has them, in general, attenuate.

Psychotria Pickeringii var. **solanoides** (Turrill) Fosberg, comb. nov.

Psychotria solanoides Turrill in Jour. Linn. Soc. Bot. **43**: 28. 1915.

This plant differs from the variable *P. Pickeringii* A. Gray only in the rusty puberulence on most of its parts and in the shortly pedicellate flowers and fruits.

Viti Levu: Tholo North: Nandarivatu, *Gillespie 4376* (NY), *Degener 14522* (USNA, A) (type locality). Vanua Levu: Thakaundrove: South slope of Korotini Range, below Navitho Pass, *Smith 495* (GH, NY, US) (compared with type by A. C. Smith).

Some specimens, such as *Degener 13582*, from Nandarivatu, are intermediate, in that they have the puberulence but have sessile flowers.

Psychotria taviunensis Gillespie in Bishop Mus. Bull. **74**: 34. *f. 48*. 1930.

Vanua Levu: Thakaundrove: Savu Savu Bay region, Vatunivuamonde Mt., *Degener & Ordonez 13999* (USNA, A); eastern buttress of Mt. Ndikeva, *Smith 1892* (GH, NY, US). Taveuni: *Gillespie 4722* (NY, isotype), *Smith 752* (GH, NY, US).

The Vanua Levu collections represent an extension of the range of this species from Taveuni. It is closest to *P. griseifolia* S. Moore, known as yet only from Viti Levu, but has more robust, more closely branched and more floriferous cymes, acuminate leaves, and rusty pubescence. The cymes are about 4-times branched.

Psychotria griseifolia S. Moore in Jour. Linn. Soc. Bot. **39**: 153. 1909.

VITI LEVU: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14524* (USNA, A); vicinity of Nandarivatu, *Degener 14336, 14461* (both USNA, A); Mt. Matomba, near Nandarivatu, *Degener 15632* (USNA, A).

The specimens which I have seen that seem referable to this species are all in fruit, while the type (*Gibbs 706*) was in flower, and so it is not positive that they belong here. However, since the description seems to fit otherwise, I feel safe in adding a description of the fruit from these specimens. This shows definitely that the species belongs to the *Piptilema* group.

Fruit, when dry, strongly hastate, usually about as broad as long, 7–10 mm. long and broad, compressed but with strong keels, the base acute, the apex produced, blunt, variable; pyrenes slightly smaller, flat, acute or slightly acuminate at base, prominently hastate, the lobes rounded, abruptly contracted distally, the apical lobe rounded, variable in degree of elongation, with dorsal keel high in middle, low and somewhat grooved or doubled apically, tapering off toward base.

Moore does not mention the fact that the leaves of this species, when dry, are conspicuously white-reticulate-veined.

The following variety seems somewhat distinct.

Psychotria griseifolia var. **unicarinata** Fosberg, var. nov.

Ramuli dense ferrugineo-puberulentes; folia obovata acuminata basi cuneata, valde albo-reticulata, infra vix puberuli; petioli cymaeque puberulentes.

Branchlets densely rusty-puberulent; leaves large, chartaceous, obovate, acuminate at apex, cuneate at base, conspicuously white-reticulate-veined and thinly puberulent beneath, the petiole 1–2.5 cm. long, puberulent; cymes puberulent; otherwise as in *P. griseifolia*.

VITI LEVU: Tholo North: Mt. Matomba, Nandala, vicinity of Nandarivatu, Feb. 28, 1941, *Degener 14640* (A, TYPE), *14510* (A), *14730* (A); Nauwanga, same general locality, *Degener 14624* (USNA, A); Namosi: Naitarandamu Mt., *Gillespie 3093* (NY).

Gillespie had indicated his specimen as a new species. Vegetatively this variety resembles *P. St.-johnii* and *P. Degeneri* so much as to be mistaken for them, but the fruits are quite different.

Psychotria filipes A. Gray in Proc. Am. Acad. **4**: 46. 1860.

Glabrous; leaves obovate, long-acuminate, cordate at base, up to 10 cm. long and 5 cm. wide, the petiole 1.5–3 cm. long; stipules calyptrate, up to 2 cm. long, with very short free tips; cymes 4 at a node, terminal, about 8 cm. long, very slender, pendent, the peduncle 4–6 cm. long, the branches 4, these twice trichotomous, the branchlets ending in single flowers or slightly irregular clusters of 2 or 3 flowers; flowers with calyx about 0.5 mm. long, acutely 4-dentate, the corolla with tube 2 mm. long, 1 mm. thick, the lobes 1 mm. long, ovate, spreading, the tips of anthers exserted.

WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (US, TYPE).

Other than the type, all of the material that I have seen referred to this species differs in being noticeably pubescent and in having more robust erect cymes, as well as much more prominently reticulate-veined leaves. Gillespie's description (in Bishop Mus. Bull. **74**: 33. 1930) says "a glabrous shrub" but his plate (op.

cit. *f. 46*) shows a plant much more like the other specimens mentioned rather than the type. I have not seen his specimen. These plants fit fairly well the description of *P. griseifolia* S. Moore.

Psychotria aurantiocarpa Fosberg, sp. nov.

Frutex glaber gracilis; folia anguste obovata vel oblanceolata valde acuminata; stipulae calyptratae valde biaristatae; cymae geminatae pedunculatae capitulatae; fructus subsolitarius ovatus subhastatus 15–18 mm. longus, pyrenis valde alato-carinatis.

Shrub up to 4 m. tall, glabrous, with rather slender branchlets; leaves thinly coriaceous, narrowly obovate or oblanceolate, up to 10 cm. long and about 3 cm. wide, strongly acuminate at apex, acute to abruptly contracted at base, the secondary veins 8–10 on a side, rather obscure, the network very obscure, the petiole up to 1 cm. long, rather thick, very narrowly winged; stipules calyptrate, ovate, each with 2 long aristate free tips, about 12 mm. long, of which 7 mm. is free tip; inflorescences terminal, in pairs, the peduncle 2–2.5 cm. long, apparently bearing several sessile or subsessile flowers (but known only in fruit); only 1 or 2 fruits maturing on a peduncle, these ovate, flattened, subhastate, rounded at base, subtruncate at apex, 15–18 mm. long, about 10 mm. wide, the pyrenes slightly smaller, abruptly slightly narrowed (subhastate) about ⅓ the way up, the lower part flat, the median dorsal keel very thin, wing-like, extending from just above base to near apex.

Vanua Levu: Thakaundrove: Mt. Mariko, dense forest, alt. 600–866 m., Nov. 14, 1933, *Smith 449* (GH, NY, type, US).

Appears to be closest to *P. Pickeringii* var. *solanoides* (Turrill) Fosberg, but differs in being glabrous and in having much longer peduncles and larger fruits.

Psychotria monocarpa Fosberg, sp. nov.

Frutex glaber gracilis; folia obovata obtusa chartacea; stipulae angustatae aristatae; fructus hastulatus sessilis terminalis solitarius aurantiacus 6–7 mm. longus, pyrenis valde carinatis.

Shrub 3–4 m. tall, glabrous, with slender branchlets; leaves chartaceous, obovate, up to 6 cm. long and 3 cm. wide, the apex obtuse, the base cuneate-attenuate, the veins not very prominent, 6–8 on a side, the petiole slender, up to 12 mm. long; stipules calyptrate, very narrow, about 5 mm. long, the free tips short, aristate; flowers unavailable; fruits bright orange, sessile, terminal, solitary (flowers possibly more numerous), ovoid, 6–7 mm. long, 3–4 mm. wide, abruptly narrowed about half-way up (hastulate), the pyrenes only slightly smaller, flat but with a very high dorsal keel almost as long as body of pyrene.

Vanua Levu: Thakaundrove: Natewa Peninsula, hills south of Natewa, alt. 400–600 m., June 12, 1934, *Smith 1951* (GH, NY, type, US).

This is probably closest to *P. Pickeringii* A. Gray, but differs from that variable species in the obovate obtuse leaves and in the solitary slightly smaller fruits.

Psychotria cordata A. Gray in Proc. Am. Acad. **4**: 46. 1860.

Glabrous; leaves slightly obovate, long-acuminate, cordate at base, the blade 6 cm. long, the veins not especially prominent, the petiole 2.5 cm. long; inflorescence capitate, sessile, terminal; fruit 7–9 mm. long.

Without definite locality: *U. S. Expl. Exped.* (US, type).

Psychotria cordata A. Gray var. **podantha** Fosberg, var. nov.

Folia breviter acuminata, nervis infra albis; fructus pedicellatus 10–13 mm. longus.

Differs from the U. S. Exploring Expedition material in having the leaves more shortly acuminate, more often obovate, the veins white beneath, the fruit

(and probably flowers) on pedicels 1–2 cm. long, and the fruit itself 10–13 mm. long.

VITI LEVU: Tholo North: Nauwanga, vicinity of Nandarivatu, *Degener 14831* (USNA, TYPE, A) (Mar. 31, 1941), *14827* (USNA, A), *14829* (USNA, A).

A small tree, up to 5 m. tall, with orange fruit.

Psychotria serpens L. var. **parvula** (A. Gray) Fosberg, comb. nov.

Psychotria parvula A. Gray in Proc. Am. Acad. **4**: 45. 1858.

Psychotria minor Turrill in Jour. Linn. Soc. Bot. **43**: 27. 1915.

This form does not differ constantly in any respect from all Asiatic specimens of *P. serpens,* although the small leaves, short internodes, and resulting crowded leaves give it an aspect different from the greater part of the Asiatic material. Good flowering specimens are not available, but if *P. minor* is correctly placed here the non-barbate corolla-throat may prove to be a good character. However, even the Fijian plants vary so much that no more than varietal separation is possible.

VITI LEVU: Tholo North: Vicinity of Nandarivatu, *Degener 14378* (USNA, A). VANUA LEVU: Thakaundrove: Mt. Mbatini, *Smith 692, 693* (both GH, NY, US); Yanawai River region, Mt. Kasi, *Smith 1760* (GH, NY, US). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (NY, ISOTYPE).

The type of *P. minor,* which I have not seen, is *im Thurn 21,* from the top of Mt. Victoria, Viti Levu.

Psychotria macroserpens Fosberg, sp. nov.

Frutex scandens glaber; folia ovalia obtusa; stipulae caducae triangulares; cyma hemispherica ramis crassis trichotomis; fructus globosus 8 mm. longus, pyrenis rugosis 3–4-carinatis.

Glabrous liana; leaves oval to almost rotund, up to about 6 cm. long and 4.5 cm. wide, obtuse or rounded at apex, strongly contracted at base, subcoriaceous, with 6 or 7 secondary veins on a side, the petioles 8–15 mm. long; stipules caducous, low-triangular, obtuse, about 2 mm. long; cyme 4–8 cm. long, 3–6-times trichotomous, hemispheric, the branches thick, densely papillose, the internodes short; flowers not seen, said by collector to be white; fruit white, spherical to slightly elongate, about 8 mm. long, crowned by a short, obtusely and irregularly dentate, puberulent calyx-ring, the rest of fruit glabrate, the pyrenes orbicular, with 3 or 4 blunt rugose keels.

KAMBARA: In forest on limestone formation, alt. 0–100 m., March 2, 1934, *Smith 1246* (GH, NY, TYPE, US).

This species seems, like *P. tephrosantha* A. Gray, to be a Fijian derivative of the widespread *P. serpens* L. It differs from both *P. serpens* and *P. tephrosantha* in its broad, almost orbicular leaves, heavy inflorescence, and much larger fruits.

Psychotria Archboldiana Fosberg, sp. nov.

Arbor parva; folia elliptica; stipulae subpersistentes striatae; cyma capitata vel subcapitata vel tricapitata terminalis; calyx viridis patens; corolla glabra; fructus obovoideus subtruncatus, pyrenis basi obtusis apice valde emarginatis dorso tuberculatis.

Small tree, up to 3 m. tall, slender, glabrous; leaves elliptic, up to 10 cm. long and 4 cm. wide, usually smaller, acute or slightly acuminate at apex, acute or slightly attenuate at base, chartaceous, the secondary veins 6–8 on a side, not very prominent, the petiole 5–10 mm. long; stipules triangular, about 5–6 mm. long, becoming free, more or less striate longitudinally, subpersistent, breaking transversely, the basal portions remaining on the nodes for some time; cymes terminal,

about 2 cm. long, capitate or subcapitate, or trichotomous, then bearing 3 capitate clusters; calyx green, spreading, about 3–5 mm. wide, obtusely lobed; corolla glabrous, apparently salverform (buds only available), the limb in bud much thicker than tube, rounded at apex; fruit obovoid, 6 mm. long, 4 mm. wide, subtruncate at apex, crowned with shrivelled remains of calyx, the pyrenes obtuse at base, deeply emarginate at apex with a projection in the sinus, dorsally strongly and irregularly tuberculate, 6 mm. long, 4 mm. wide.

Viti Levu: Tholo West: Naruku, vicinity of Mbelo, near Vatukarasa, alt. 250 m., May 18, 1941, *Degener 15316* (USNA, type, A); Yawe, same general locality, *Degener 15291* (USNA, A); Uluvatu, same general locality, *Degener 15258* (USNA, A); Mbulu, near Sovi Bay, alt. 0–60 m., *Degener 15049* (USNA, A).

This species is apparently closest to *P. pacifica* K. Schum., of Samoa, from which it differs in its much smaller leaves with fewer nerves, smaller stipules, simpler and much smaller inflorescence, and glabrous flowers. It is vegetatively much like *P. Gillespieana* A. C. Sm., but differs in its condensed inflorescences and expanded green calyces. The fruits and flowers are much like those of *P. carnea* (Forst.) A. C. Sm., but smaller, and it also differs in its much smaller and thinner leaves with fewer veins, and in its condensed cymes. It probably belongs to the same group of species (Sect. *Eumachia* (DC.) A. C. Sm.). It lacks the anthocyanin pigment commonly found in members of the genus. The native name (Serua dialect) is *vunga*, and a tea made from the leaves is said to be used medicinally.

Psychotria brevicalyx Fosberg, sp. nov.

Arbor parva *P. turbinatae* A. Gray affinis, sed foliis crassioribus infra pubescentibus, cyma pauciflora conspicue pubescente, pedunculo longiore et crassiore, fructu pubescente calyce brevissimo coronato.

Small tree, up to 3 m. tall, the young parts pubescent, glabrate; leaves ample, elliptic to obovate, up to 20 cm. long and 9 cm. wide, bluntly acute at apex, cuneate at base, chartaceous, pubescent beneath, especially on midrib, the secondary veins 11–15 on a side, moderately prominent, the network more or less obscure, the petioles up to 3 cm. long; stipules calyptrate, caducous, densely pubescent, 1–1.5 cm. long, with well developed free tips which are glabrous on inner surface; cymes 2–4 in falsely terminal clusters, 6–10 cm. long, long-pedunculate, stiff, branched 2–4 times, pilose with dirty-whitish hairs, the peduncle up to 8 cm. long; fruits on pedicels 3–7 mm. long, red, turbinate, 7–8 mm. long, 5–6 mm. wide, pilose, crowned with the exceedingly short 5-denticulate calyx-ring, the pyrenes 6 mm. long, 4 mm. wide, truncate above, acute below, the lower part flat, the upper part strongly tricarinate, with a deep ventral groove at distal end; corollas not available except for one persisting on a fruit of *Degener 15154*, which may not be normal, but is about 1 cm. long, salverform, with a thick densely tomentose tube and broad orbicular lobes about 5 mm. long, said to be white.

Viti Levu: Tholo West: Yawe, vicinity of Mbelo, near Vatukarasa, alt. 300 m., May 15, 1941, *Degener 15292* (USNA, type, A); Uluvatu, same general locality, *Degener 15256* (USNA, A); *Tabualewa 15620* (USNA, A); Serua: Vatuvilakia, vicinity of Ngaloa, alt. 0–150 m., *Degener 15154* (USNA, A).

Close to *P. turbinata* A. Gray, but differing in the pubescent under surface of the thicker leaves, and in the stiff, heavier, fewer-flowered, conspicuously pubescent cymes and pubescent fruit. The cymes of *P. turbinata* are minutely puberulent, with a much shorter peduncle.

Psychotria crassiflora Fosberg, sp. nov.

Arbor parva *P. turbinatae* A. Gray affinis, sed foliis amplis obovatis, apicibus liberis stipulorum duris linearibus, cyma pauciflora, floribus valde carnosis, tubo corollae intus solido.

Small tree, the vegetative parts glabrous, the branchlets rather thick and somewhat fistulose; leaves ample, obovate, up to 21 cm. long and 10 cm. wide, the apex slightly bluntly acuminate, the base cuneate, the secondary veins 15 or 16 on a side, rather prominent, widely spreading, anastomosing near margin, the petiole 1–3 cm. long; stipules caducous, rather variable in size, up to 2 cm. long, the lower parts united, the upper part prolonged into 2 stiff linear aristae about 1 cm. long; cymes 3 at a node (often 1 or 2 broken off), about 10 cm. long, heavy, stiff, erect, 2- or 3-times trichotomous, thinly hirtellous, glabrate, the pedicels 6–12 mm. long, thickened upward, thinly hirtellous; flowers fleshy; calyx campanulate, 5–6 mm. long and wide, truncate, thick and fleshy-coriaceous, the free portion 3 mm. long, with upper edge calloused and appearing like a scar, bearing inside around the base a single circle of long delicate hairs, otherwise smooth internally, externally slightly hirtellous, glabrate; corolla cylindric or slightly swollen near base, contracted at base to a small attachment, very thick and fleshy-coriaceous in texture, densely sericeous-hirtellous externally, the lobes 5 or 6, erect, about 4 mm. long and 2 mm. wide, oblong, conspicuously hooked at apex, finely puberulent within except inside of hook which is hirtellous with the hairs pointing downward, the throat somewhat bearded with longer hairs pointing upward, the somewhat swollen tube filled solidly with tissue except at extreme base, closely investing style, a cavity at extreme base about 1 mm. wide and high containing the small hemispheric disk; anthers linear-oblong, 3 mm. long, on very short filaments, attached near base, inserted in corolla-throat; style glabrous, filiform, 8 mm. long, deeply bifid at apex, the lobes not thickened, about 2 mm. long; ovary 2-celled, with a single erect basal ovule in each cell; only one fruit available, probably not mature, turbinate, about 1 cm. long and broad.

Viti Levu: Serua: Vatutavathe, vicinity of Ngaloa, alt. 150 m., May 5, 1941, *Degener 15178* (USNA, type, A).

This species is apparently related to *P. turbinata* A. Gray, but differs from it in the larger, more obovate leaves, in the stipules with stiff, linear, free tips instead of expanded foliaceous ones, in the much fewer-flowered cymes, and, if Gillespie's interpretation (in Bishop Mus. Bull. **91**: 36. *f. 41.* 1932) of *P. turbinata* is correct, in the entirely different flowers.

The fleshy corolla with the tube filled with tissue is unknown in *Psychotria,* but in every other respect the plant matches this genus. The possibility is, of course, not excluded that the corolla character is the result of an insect sting, but it was uniform in all flowers dissected, and no evidence was found of insect activity.

Psychotria furcans Fosberg, sp. nov.

Frutex vel arbor parva; folia elliptica petiolata; stipulae supra furcantes in laminas lanceolatas; cyma terminalis solitaria laxa pentachotoma dura, ramulis elongatis, corollis extra glabris intus dense barbatis; fructus late ellipsoideus, in sicco tuberculatus calyce persistente coronatus, pyrenis subhastatis dorso multicarinatis, carinis tenuibus eroso-incisis.

Shrub or small tree with slender branches, the vegetative parts glabrous; leaves elliptic or oblong, acute at both ends, subcoriaceous, about 8 cm. long, 2.5–3.5 cm. wide, on petioles 1–1.5 cm. long, the veins 10 or 11 on a side, not especially prominent; stipules about 1 cm. long, united below, forked above into 2 lanceolate free blades sometimes over half total length of stipules; cyme solitary, terminal, glabrous, 7–10 cm. long, loosely branched, the branches with a stiff appearance, the peduncle 2–5 cm. long, with a tendency to be reflexed, the primary branches 4 or 5, each branching 2 or 3 times; flowers shortly pedicellate; open flowers unavailable, the buds with calyx hemispheric to somewhat spreading, 1–1.5 mm. long, the margin subentire to irregularly obtusely dentate, the corolla glabrous

but appearing somewhat scurfy in bud, densely bearded within at top of tube; style glabrous, filiform, about 12 mm. long, shortly bifid at apex; fruit broadly and irregularly ellipsoid, 12 mm. long including the persistent somewhat enlarged calyx, 7–8 mm. wide, red, the pyrenes 9 mm. long, 6.5 mm. wide, ovate, rather flat and expanded into a thin wing-like portion below, the apical portion contracted and protruding, producing a subhastate outline, subtruncate at apex, shortly tridentate, the whole with a very prominent thin median dorsal keel and several secondary keels on each side, these broken or erose-incised, giving a more or less spinose appearance, and causing the fruit to be strongly tuberculate when dry.

Viti Levu: Tholo North: Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. 750–900 m., Feb. 18, 1941, *Degener 14450* (USNA, type, A) (flowering). Vanua Levu: Thakaundrove: Eastern drainage of Yanawai River, alt. 20–160 m., *Degener & Ordonez 14092* (USNA, A) (fruiting).

Differs from its relatives, *P. edentata* A. C. Sm. and *P. pachyantha* A. C. Sm., in its smaller, elliptic, longer petiolate leaves, conspicuously forked stipules, and slender, rather stiff, usually pentachotomous cymes with elongate branches. It is entirely possible that the two collections associated here do not belong together, since the localities are so far apart and at different altitudes, and one is known only in flower and the other in fruit, but no differences of much consequence are evident between them.

Psychotria pittosporifolia Fosberg, sp. nov.

Arbor parva glabra; folia spathulato-obovata flavo-virides; stipulae connatae apice liberae et bifidae; cyma terminalis multiflora viridi-puberulenta; flores sessiles, calyce brevi dense puberulo, corolla hypocraterimorpha sparse puberula intus barbata, antheris exsertis.

Small tree about 3 m. tall, the vegetative parts glabrous; leaves spatulate-obovate, up to about 10 cm. long and 4.5 cm. wide, usually abruptly short-acuminate at apex, cuneate-attenuate at base into a petiole 1–2 cm. long, the blade subcoriaceous with margin slightly revolute, drying greenish-yellow above, paler beneath; stipules 8–10 mm. long, calyptrate, with 4 prominent free tips resulting from bifid apices; cymes solitary or rarely 2, terminal, many-flowered, up to 7 cm. long, greenish-puberulent, the peduncles up to 4 cm. long, the primary branches usually 5, these branched 3 or 4 times, ending in a cluster of 2–4 sessile flowers; calyx less than 1 mm. long, shallowly 5-dentate, densely puberulent; corolla white, salverform, 8–9 mm. long, the tube about 5 mm. long, very sparsely puberulent without, glabrous within below, densely bearded in upper part, the lobes oblong, about 4 mm. long, densely puberulent without, tomentose within; anthers about 1 mm. long, exserted on filaments about 2 mm. long; style glabrous, filiform, bifid above.

Viti Levu: Serua: Vatutavathe, vicinity of Ngaloa, alt. 150 m., May 5, 1941, *Degener 15180* (USNA, type, A); near Mt. Ngamo, vicinity of Ngaloa, *Degener 15059* (USNA, A).

Perhaps there are two types of flowers in this species, as the anthers are less exserted in some. However, this may be a matter of age. The corolla-tube is also rather variable.

This plant differs from the closely related *P. chrysophylla,* also of Viti Levu but from Tholo East, in its spatulate-obovate leaves, attenuate to the base, smaller calyx, and corolla pubescent within the longer lobes. The similarity in aspect to certain species of *Pittosporum* suggests the name.

Psychotria Degeneri Fosberg, sp. nov.

Arbor parva; folia ampla elliptica vel anguste obovata acuminata albo-reticulata pilosa; stipulae calyptratae pilosae; cymae 3–10 terminales pallide pilosae; flores

albi, calyce breviter campanulato non venuloso, corolla infundibuliformi extra sparse pilosa; fructus clavatus.

Small tree up to 5 m. tall, the branchlets glabrous or very early glabrate; leaves chartaceous, elliptic to narrowly obovate, up to 25 cm. long and 10 cm. wide, acuminate at apex, cuneate at base, more or less pilose on both sides, especially beneath, densely so on midrib and veins, sometimes somewhat glabrate; strongly and conspicuously venulose, the veins white in dried specimens, the secondaries 13–20 on a side, connected by a strong network, the petiole up to 6 cm. long, pilose; stipules calyptrate, early caducous, pilose, about 1 cm. long, the free tips small; cymes loose, slender, or somewhat shortened and contracted, 2–6 cm. long, whitish- to brownish-pilose, borne 3–10 together terminally, perhaps representing a single ample cymose panicle of which the peduncle has been suppressed, each branched 2 or 3 times, each branchlet bearing 2 or 3 shortly pedicellate white flowers; calyx and hypanthium pilose, the calyx shortly campanulate, about 1 mm. long, shallowly 5-lobed to subtruncate, not veiny; buds club-shaped, rounded at apex, the corolla funnelform, 8 (–11) mm. long, glabrous within, sparsely pilose externally, especially toward apex, 5-lobed, the lobes ovate, 2 mm. long; anthers oblong, 1.5 mm. long, attached subbasally on free filaments of about the same length, inserted below sinuses, the anthers exserted almost their length; disk hemispherical, the style glabrous, filiform, 5 mm. long, bifid 1.5 mm. at apex, the lobes flattened; fruit clavate, 7 mm. long, the pyrenes acute at base, truncate at apex, tricarinate dorsally, the keels somewhat irregular.

Viti Levu: Ra: Tuvavatu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., May 30, 1941, *Degener 15374* (USNA, type, A); Tholo North: Nandarivatu, *Greenwood 848* (USNA, A); Mt. Matomba, Nandala, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14447* (A); Serua: Vatutavathe, vicinity of Ngaloa, alt. 0–150 m., *Degener 15214* (A) (inflorescence condensed).

This is close to *P. St.-johnii* Fosberg, but differs in its usually glabrous branchlets, generally whitish or light brown pubescence, non-venulose calyces, longer, funnelform corollas which are sparsely pilose externally, and clavate rather than ovoid fruit.

Psychotria tetragonoides Fosberg, sp. nov.

Arbor parva; folia elliptica infra pilosa; stipulae ferrugineo-tomentosae; cyma terminalis sessilis, floribus albis, calyce truncato, corolla infundibuliformi valde lobata extra sparse pubescente intus glabra, antheris exsertis; fructus turbinatus vix pedicellatus.

Small tree, the branchlets rusty-tomentose when young, glabrate; leaves elliptic, up to 17 cm. long and 5.5 cm. wide, chartaceous, the apex acuminate, the base cuneate to attenuate, the margin somewhat revolute, the upper surface glabrous, the lower surface pilose, especially on midrib, the petiole 2–3 cm. long; stipules 1–1.5 cm. long, densely rusty-tomentose, the pair surrounding the inflorescence forming a more or less globose terminal bud, the free apices not well developed; inflorescence terminal, capitate, sessile (pedicels slightly developed in fruiting plant); flowers white; calyx very short, truncate; corolla funnelform to salverform, 15 mm. long, thinly pubescent without, glabrous within, the tube 9–10 mm. long, the lobes 6 mm. long, ovate; anthers oblong, 1.5 mm. long, exserted on short filaments; style filiform, glabrous, slightly enlarged upward, bifid at apex into 2 flattened lobes 2 mm. long; disk hemispheric; fruit red, turbinate, 8 mm. long, 5–6 mm. wide, quite fleshy, the pyrenes roughly triangular, 6 mm. long, 4 mm. wide, truncate at apex, acute at base, with a constriction near apex, 3 blunt dorsal keels in apical part, and a sinus or groove ventrally at apex.

Viti Levu: Serua: Vatutavathe, vicinity of Ngaloa, alt. 150 m., May 5, 1941, *Degener 15213* (USNA, type, A); Tholo North: Nandrau, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14919* (USNA, A).

Very similar to *P. tetragona* Seem. but differing in the broader leaves which are pubescent beneath, the stipules without long curved apices, the pubescent corollas, and the more turbinate fruits with smaller pyrenes with much shorter keels. Easily told from *P. levuensis* Gillespie by the capitate inflorescence.

Psychotria timonioides Fosberg, sp. nov.

Ramuli ferrugineo-tomentosi; folia coriacea, oblanceolata vel anguste obovata, supra aurea glabra, infra pallida sparse pilosa; stipulae dense ferrugineo-tomentosae; cymae laxae dense glandulari-pubescentes, primo quadrichotome deinde trichotome deinde dichotome ramosae, quoque nodo 1-floro (flore terminali sessili), ramulis ultimis 3-floris floribus sessilibus; hypanthium basi articulatum; calyx disciformis integer.

Branchlets terete, 3–4 mm. thick, densely rusty-tomentose; leaves oblanceolate to narrowly obovate, up to 12 cm. long and 4.5 cm. wide, acute at apex, cuneate at base, coriaceous, above glabrous, lustrous, golden-yellow (when dry), beneath pale and sparsely pilose, the midrib densely so, the margins revolute, the petiole thick, 1.5–2 cm. long, densely rusty-tomentose; stipules densely rusty-tomentose, well-developed ones not available; cymes loose, 3 at a node, becoming lateral, densely glandular-pubescent, 6 cm. long (peduncle about 4 cm.), branched quadrichotomously, then trichotomously, then dichotomously, at each node, in addition to the branches, with a sessile terminal flower, each ultimate branchlet bearing a cluster of 3 sessile flowers, the flowers with an articulation at base of hypanthium; calyx pubescent without, glabrous within, thick-chartaceous, spreading to form a disk about 5 mm. across, the margin entire; disk hemispheric; corollas and mature fruit unavailable.

Viti Levu: Serua: Vatutavathe, vicinity of Ngaloa, in forest, alt. 150 m., May 5, 1941, *Degener 15180a* (A, TYPE, USNA).

Two twigs of this remarkable species were found mixed with the type collection of *P. pittosporifolia* Fosberg, which it resembles in the yellow upper surface of the leaves. Vegetatively *P. timonioides* resembles *P. Imthurnii* Turrill, but the longer, looser, peculiarly branched inflorescence and disk-like calyx do not much resemble any species of Psychotria familiar to me. The superficial resemblance of the inflorescence to that of *Timonius* suggests the specific name.

Readea Gillespie

The genus *Readea* has been considered to be monotypic since it was described by Gillespie in 1930. The original species, *R. membranacea,* has been collected a number of times and, although it is close to *Psychotria,* the peculiar calyx, the disk gradually attenuate into the style rather than surrounding it, and the large subcylindric fruits seem to set it off sufficiently. Two other plants have been collected in fruit which seem to be more correctly placed here than in *Psychotria.* They are described below. Of course, when they are collected in flower, if the flowers do not show the peculiar structure of *Readea,* some other disposition will have to be made of them.

Readea membranacea Gillespie in Bishop Mus. Bull. **74:** 35. *f. 49.* 1930.

Vanua Levu: Mbua: Southern portion of Seatovo Range, alt. 100–360 m., *Smith 504* (US, GH, NY); Thakaundrove: Vatunivuamonde Mt., Savu Savu Bay region, alt. 250 m., *Degener & Ordonez 14005* (USNA, A).

This species has previously been known from Taveuni and Viti Levu.

Readea roseata Fosberg, sp. nov.

Arbor parva glaber; folia late oblanceolata vel obovata obtusa chartacea; stipulae ovatae caducae; cymae in fructu axillares trichotomae; fructus cylindricus vel

fusiformis roseus 12 mm. longus 3–4 mm. latus, pyrenis dorso vix costatis apice subtruncatis.

Small tree 3 m. tall, glabrous; leaves broadly oblanceolate to narrowly obovate, up to 9 cm. long and 3.5 cm. wide, obtuse to acutish at apex, gradually, then abruptly, contracted at base to a petiole about 1 cm. or less long, the secondary veins 11 or 12 on a side, widely spreading, not very prominent; stipules ovate, early caducous; flowers not available; fruiting cymes axillary, borne in threes in the axil of one leaf, 3-fruited, the peduncle 1–1.5 cm. long, the pedicels 0.5–1 cm. long; fruits cylindric to fusiform, "deep pink," up to 12 mm. long, 3–4 mm. thick, appearing subtruncate at apex, but with a somewhat raised disk, the calyx mostly lost, but several damaged persistent ones 7–8 mm. long, tubular, lobed; pyrenes 8 mm. long, very shallowly ridged dorsally, subtruncate at apex.

Viti Levu: Tholo North: Nauwanga, vicinity of Nandarivatu, alt. 750–900 m., Mar. 13, 1941, partly open rocky forest, *Degener 14818* (USNA, type, A).

This plant seems related to *R. membranacea,* although it is known only in fruit. The leaves are smaller, thicker, and more obtuse. The cymes are much shorter and only once-branched, while the fruit is also much smaller. Flowering specimens are very much desired to confirm the generic position.

Readea prismoclavata Fosberg, sp. nov.

Planta glabra nodosa; folia obovata subcoriacea; stipulae bifidae infra petiolem adnatae; fructus terminalis solitarius prismoclavatus quadrangularis truncatus.

Plants glabrous, the branchlets with prominent nodes; leaves obovate, about 5 cm. long and 2.5 cm. wide, rounded to subacuminate at apex, cuneate at base, subcoriaceous, with about 8 veins on a side, the petioles 6–10 mm. long; stipules fused with petioles at base, about 5 mm. long, bifid at apex into lanceolate lobes; flowers unavailable; fruit solitary, terminal, on a pedicel 10–12 mm. long, the body of fruit clavate-prismatic, 16–18 mm. long, 5–8 mm. wide, roughly 4-sided, truncate at apex, with a prominent calyx-scar surrounding a depressed disk, with a prominent style-base, attenuate at base.

Viti Levu: Namosi: Vakarongasiu Mt., alt. 800 m., *Gillespie 3272* (GH, type).

This specimen, judging by the similarity of the fruit to that of *R. membranacea,* and of the leaves to those of *R. roseata,* should go into this genus, rather than into *Psychotria,* where Gillespie referred the specimen.

Calycosia A. Gray

Of the two original species in the genus *Calycosia,* A. C. Smith (in Bishop Mus. Bull. **141**: 153. 1936) has selected *C. petiolata* A. Gray of Fiji as the type. For several reasons the genus is not at all well understood. Considerable confusion has resulted from Gray's later inclusion in the genus of species of *Psychotria* which have an enlarged and flaring or reflexed calyx-limb. In this he was followed by Turrill and by Gillespie. The latter, however, aware of the discrepancy, placed the original elements of *Calycosia* in the genus *Uragoga* L. and used *Calycosia* for the discrepant ones. This confusion was cleared up by Smith (l. c.), who restored *Calycosia* to its original sense and erected the genus *Calycodendron* to accommodate most of the later accretions to *Calycosia.*

Gillespie, basing his judgment on the extremely inadequate fragment of the U. S. Exploring Expedition material in the Gray Herbarium, interpreted *C. petiolata* as the species described below as *C. macrocyatha,* or at least as including this species. Smith (l. c.), with some doubt, followed this disposition, as did I in working up St. John's Fijian Rubiaceae in 1939. A careful comparison with the U. S. Exploring Expedition specimens in Washington and New York shows

that *C. petiolata* is quite a distinct thing from most of the material that has been referred to it.

The principal difficulty with this genus lies in the inadequate or poorly preserved material usually obtained of it. The large water-soaked heads of flowers do not press particularly well, and are very likely to become moldy. Extra heads seldom accompany collections, and one hesitates to damage a specimen by dissecting the inflorescence from it. Consequently, the morphology of the inflorescence is not well understood, and it must be admitted that the present treatment does not particularly help in this direction. Yet, the peculiar inflorescence with its involucrate bracts at each ramification seems to be the principal feature that keeps the species concerned out of *Psychotria*. The large funnelform and deciduous calyx, by itself, would scarcely set the group off generically.

Judging from the material at present available to me, there are at least three Fijian species in *Calycosia*. Of these, one is complex and may be subdivided into two varieties which may later be found to be species. I am not familiar enough with the Samoan and Tahitian species referred to this genus to decide whether they belong here or not. The following key will separate, by superficial characters not requiring dissection of the inflorescence, the three species and two varieties recognized in Fiji.

Heads relatively numerous, cymose-paniculate, the outer bracts 2 cm. or less long, open on one side, not united into a cup-like or flask-like structure ..... *C. petiolata.*
Heads few (1 or 3), the outer bracts usually 2.5 cm. long or longer, completely united except at apex.
Heads solitary, 1–1.6 cm. wide at anthesis (wider in fruit), the apical opening strongly contracted at anthesis ..... *C. lageniformis.*
Heads in threes, at least 2 cm. wide and with a wide opening at anthesis ... *C. macrocyatha.*
Heads borne in a sessile involucre ..... *C. macrocyatha* var. *macrocyatha.*
Heads borne in a pedunculate involucre ..... *C. m.* var. *kandavuensis.*

A specimen collected on Koro (*Smith 970*, GH, NY, US) is not placed, as the material at hand is inadequate. It has the broad glabrous leaves of *C. macrocyatha* but has a cymose-paniculate fruiting inflorescence similar to that of *C. petiolata*. My notes taken from the sheet of this number at New York suggest that it should probably be associated with *C. petiolata*.

Calycosia petiolata A. Gray in Proc. Am. Acad. **4**: 48. 1860.
Uragoga petiolata Gillespie in Bishop Mus. Bull. **74**: 37. 1930.

Shrub or small tree; leaves thick-chartaceous to subcoriaceous, narrowly elliptic to elliptic-oblanceolate, up to 30 cm. long and 10 cm. wide, usually sharply acuminate at apex, attenuate to a petiole at base, sparsely pilose beneath, at least near midrib; stipules united near base, bifid at apex, the margins fimbriate-ciliate; heads several to many, in a small hemispherical cymose panicle, each head about 15 mm. high and broad, the bracts at ramifications of panicle and those closely investing heads whitish, open on one side, densely fimbriate-ciliate; calyx just under 1 cm. long, cut at apex into oblong lobes about 3 mm. long, fimbriate-ciliate; corolla about twice as long as calyx, the lobes hirtellous toward apex, the throat densely woolly; bracts deciduous from the somewhat enlarged fruiting inflorescence; fruits oblong, about 7 mm. long, truncate at apex, crowned by subpersistent calyx, acutish at base, the pyrenes not keeled, but at most slightly ridged dorsally.

Viti Levu: Ra: Tuvavatu, vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15379* (USNA, A); same general locality, *Degener 15522* (USNA, A); Tholo North: Nandarivatu, alt. 800–900 m., *Degener & Ordonez 13611* (USNA, A); same general locality,

near summit of Loma Langa Mt., *Gillespie 4288* (US). OVALAU: *U. S. Expl. Exped.* (NY). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (US, TYPE).

Calycosia lageniformis (Gillespie) A. C. Sm. in Bishop Mus. Bull. **141**: 154. 1936.

Uragoga lageniformis Gillespie in Bishop Mus. Bull. **74**: 36. *f. 50.* 1930.

To Gillespie's description may be added that, prior to anthesis at least, the involucre has, at apex, two bifid lobes about 1 cm. long. The involucre is really sessile but the two subtending leaves soon drop off. When in fruit the involucre becomes much broader and open at the apex. The fruit is about 14 mm. long, red, and quite fleshy, with the pyrenes just over 1 cm. long, slightly ridged on the back, acute at base and subtruncate or slightly dentate at apex. The calyx persists for some time, but is absent at maturity.

VITI LEVU: Tholo North: Nandarivatu, *Degener 14540* (USNA, A), *Degener & Ordonez 13607* (USNA, A).

I have not seen Gillespie's material of this species, but Degener's specimens are from the type locality.

Calycosia macrocyatha Fosberg, sp. nov.

Frutex glaber; folia elliptica vel elliptico-lanceolata, subcoriacea, petiolata; stipulae ovato-lanceolatae, 3–4 cm. longae, infra connatae, supra bifidae, caducae; inflorescentia tricapitata involucrata, involucro cyathiformi lobato quam floribus longiore; calyx tubularis, dentatus; corolla infundibuliformis glabra valde exserta.

Slender shrub, up to 4 m. tall, glabrous, with fistulose branchlets, the internodes short (1–2 cm.), at least above; leaves ample, petiolate, the blade elliptic to oblanceolate, slightly acuminate at apex, attenuate to cuneate at base, subcoriaceous, the secondary veins numerous, prominent; stipules caducous, coriaceous, ovate-lanceolate, 3–4 cm. long, the basal 1 cm. connate, the apex deeply bifid; inflorescence of 3 pedunculate heads within a large funnel-shaped or cyathiform lobed involucral bract, this either sessile or pedunculate, axillary (or to begin with, terminal), split on one side to base, up to 6.5 cm. long, "white," the peduncles of individual heads up to 5 cm. long, the heads up to 3 cm. wide and 4 cm. long, tending to be truncate at base, surrounded by a cup-shaped white involucral bract, this usually exceeding the bracts and calyces within and open and flaring at top, coriaceous when dry; within this are smaller bracts crowded together, apparently at the nodes or ramifications of the condensed vestigial cyme, each bract surrounding a cluster of flowers, each flower surrounded by a smaller bract, the margins of these inner bracts densely fimbriate-ciliate; calyx about 15 mm. long, gradually dilated upward, with 5 unequal triangular teeth, these densely fimbriate-ciliate; corolla glabrous, about 4 cm. long, curved (at least when dry), funnelform with slender tube gradually dilated upward, the lobes 5, oblong-ovate, about 8 mm. long and 3 mm. wide, somewhat spreading, acute, slightly cucullate at apex; anthers linear, the apices slightly exserted from throat of corolla; style filiform, somewhat shorter than corolla, deeply bifid at apex; fruit unavailable.

Found, so far, on Viti Levu, Vanua Levu, and Kandavu.

Two varieties are apparent in the material available. The portion of the description above concerning the flowers was drawn from var. *kandavuensis*.

Calycosia macrocyatha var. **macrocyatha** Fosberg, var. nov.

Involucrum sessile, infundibuliforme, valde lobatum, caducum.

The typical form of the species, with sessile, funnelform involucral bract 6 cm. long, cut halfway into 5 unequal obtuse lobes, early caducous.

VITI LEVU: Tholo North: Nandrau, vicinity of Nandarivatu, alt. 750–900 m., *Degener 14914* (USNA, A). VANUA LEVU: Thakaundrove: Mt. Mariko, in dense forest, alt. 600–866 m., Nov. 14, 1933, *Smith 472* (US, TYPE, NY).

Calycosia macrocyatha var. **kandavuensis** Fosberg, var. nov.

Involucrum pedunculatum campanulatum persistente.

Involucral bract campanulate, up to 4 cm. long, persistent but becoming badly frayed, on a thick peduncle up to 6 cm. long.

KANDAVU: Mt. Mbuke Levu, dense forest, alt. 750–840 m., Oct. 25, 1933, *Smith 273* (GH, NY, TYPE, US).

COPROSMA J. R. & G. Forst.

Coprosma persicaefolia A. Gray in Proc. Am. Acad. **4**: 50. 1860.

VITI LEVU: Ra: Vicinity of Rewasa, near Vaileka, alt. 50–200 m., *Degener 15353* (USNA, A); Tholo North: Nandarivatu, alt. 800–900 m., *Degener 13533* (USNA, A). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped.* (US, ISOTYPE).

The specimens cited above show certain characters not brought out by Oliver in his monograph (Bishop Mus. Bull. **132**: 138. 1935). The leaves of all three collections are considerably smaller than indicated by Oliver, so that they would key to *C. novaehebridae* rather than to *C. persicaefolia*. No. *13533* has the leaves narrowed gradually at base, rather than abruptly, which, in the key, would take it to *C. strigulosa* of Samoa. All of the collections have a peculiar type of domatia on the under surface of the leaves. These are superficial, not embedded in the blade, and seem to be lunate or hook-like outgrowths from the midrib, open toward the apex of the leaf. The vein appears to emerge from the outer curve of this structure, but an examination of the upper leaf-surface shows that the vein is really normally branched from the midrib. The leaf-margins are slightly crisped when dry. I should scarcely describe the petioles as "rather long and slender," since they are only 3–5 mm. long in these specimens. The stipules are definitely glandular-denticulate as well as conspicuously ciliate. The fruits of the U. S. Exploring Expedition specimen are somewhat ovoid, as described by Oliver, but those of no. *15353* are very small and globose. They are apparently abortive. Those of no. *15533* are well developed, 4–5 mm. long, and narrowly ellipsoid rather than ovoid. Two out of the three sectioned were 3-celled, rather than 2-celled with the third cell sterile. The pubescence, in general, is strigose, except on the margins.

No. *15353* is said to have the native name *timo* and to be used externally for aches.

CUCURBITACEAE

Coccinea cordifolia (L.) Cogn. in DC. Monogr. Phan. **3**: 529. 1881.

VITI LEVU: Lautoka: Lautoka, *Greenwood 825A* (GH) (creeper, in open sunny places; corolla pure white).

Apparently not previously reported from the Pacific, this Asiatic plant is probably a recent introduction to Fiji.

LOBELIACEAE

Lobelia zeylanica L. Sp. Pl. 932. 1753; Merr. & Perry in Jour. Arnold Arb. **22**: 386. 1941.

VITI LEVU: Tholo North: Loma Langa Trail, vicinity of Nandarivatu, alt. about 850 m., *Degener & Ordonez 13683* (GH) (along trail in rain-forest); Nandarivatu, alt. about 830 m., *Greenwood 811* (GH) (in damp grassland in open, but most common on wet shady paths in forest). VANUA LEVU: Thakaundrove: Valanga, Savu Savu Bay region, alt. 30 m., *Degener & Ordonez 13911* (GH) (in springy clearing).

The cited collections are of especial interest as representing the first record of the species, as far as I can ascertain, from east of New Guinea, and the first occurrence of the family in Fiji.

COMPOSITAE

Mikania micrantha H. B. K. Nov. Gen. & Sp. **4:** 134. 1820; Christoph. in Bishop Mus. Bull. **128:** 209. 1935.

Viti Levu: Serua: Ngaloa, near sea-level, *Degener 15084* (GH) (in wet meadow; native name: *mbosuthu*). Ovalau: Near Levuka, alt. 150 m., *Bryan 605* (GH). Kandavu: Namalata Isthmus region, near sea-level, *Smith 13* (GH, NY) (in clearings and thickets; native name: *wa mbutako*). Vanua Levu: Mbua: Lower Wainunu River valley, alt. 0–200 m., *Smith 1733* (NY) (pernicious weed, in clearings; native name: *wa mbosuvu*); Thakaundrove: Southern slope of Valanga Range, alt. 200–400 m., *Smith 391* (NY) (at edge of forest).

The fact that this vigorous and abundant weed has not previously been reported from Fiji in taxonomic literature indicates that it is probably of recent introduction.

Spilanthes acmella (L.) Murr. Syst. 610. 1774.

Vanua Levu: Thakaundrove: Valanga, Savu Savu Bay region, near sea-level, *Degener & Ordonez 13827* (GH) (in swampy pasture).

I believe that this widespread weed has not previously been recorded from Fiji; the nearest record I can locate is from New Caledonia.

Synedrella nodiflora (L.) Gaertn. Fruct. **2:** 456. *pl. 171, fig. 7.* 1791; Setch. in Carn. Inst. Publ. **341:** 41. 1924; Christoph. in Bishop Mus. Bull. **128:** 210. 1935.

Viti Levu: Rewa: Suva, near sea-level, *Degener & Ordonez 13518* (GH) (common roadside weed).

Although reported as common in many other Pacific groups, this weed has apparently not previously been reported from Fiji.

Youngia japonica (L.) DC. Prodr. **7:** 194. 1838.

Viti Levu: Tholo North: Nandarivatu, alt. about 830 m., *Greenwood 801* (GH) (in damp places; flower-heads yellow).

This species, apparently becoming naturalized, has not previously been recorded from Fiji or any of the adjacent groups. I follow the recent treatment of Babcock and Stebbins (in Carn. Inst. Publ. **484:** 94. 1937) in referring the species to *Youngia* rather than to *Crepis*.

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A CONTINUATION OF THE
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II

THE ARALIACEAE OF CHINA

BY

HUI-LIN LI

WITH FOURTEEN TEXT-FIGURES

PUBLISHED BY
THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY
JAMAICA PLAIN, MASS., U. S. A.
1942

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THE ARALIACEAE OF CHINA[1]

Hui-Lin Li

with fourteen text-figures

INTRODUCTION

This is a systematic study of the Araliaceae of China. An attempt is made to account for every published binomial belonging to this family as recorded from China in botanical literature from 1753 to the present date. Sources of all names are cited and an attempt has been made to clarify the often somewhat complicated synonymy. The work is mainly based on the extensive collection of Chinese plants at the Arnold Arboretum, supplemented by collections from other Chinese and American herbaria. The Araliaceae as a group is particularly difficult to study because of constant problems in relation to the delimitation of many genera and species. As it has been impossible for me to consult certain types preserved in European herbaria, because of war conditions, I have been obliged, in certain cases, to accept current interpretations, and thus certain conclusions must be accepted as tentative.

In adopting generic limitations generally accepted by most modern authors, seventeen genera[2] are recognized as occurring in China. Among them only *Panax* and some species of *Aralia* are herbaceous, all others being ligneous vines, shrubs or trees. *Diplopanax* is a monotypic genus confined to China. *Merrilliopanax,* herein described as a new genus from Yunnan, is also represented in India. *Tupidanthus* occurs also in India, *Tetrapanax* in Formosa, *Heteropanax* in tropical Asia, and *Kalopanax* in Japan. *Trevesia, Brassaiopsis, Macropanax,* and *Acanthopanax* are more or less widespread in southern Asia, while *Schefflera, Dendropanax, Pentapanax,* and *Aralia,* as herein interpreted, are common to both hemispheres. *Panax* is found in temperate regions of eastern Asia and North America, and *Hedera* in Asia, Europe, and North Africa. *Nothopanax* is chiefly Australian, with some species occurring in China.

Besides a few doubtful ones, a total of 121 species, 32 varieties, and 3 forms are recognized in this study. This number is about seven times that known to Forbes and Hemsley in 1888 (13), and twice the number enumerated by Chung in 1924 (6). The family is most highly developed in genera and in species in the south and southwestern parts of China. The numerous botanical explorations made in recent years in these parts of China by the Fan Memorial Institute of Biology, the Botanical Institute of Sunyatsen University, Lingnan University, and the University of Nanking, all in collaboration with the Arnold Arboretum

[1] A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Biology, Harvard University.

[2] *Plerandra* (*Diplasandra*) *jatrophifolia* Hance (Jour. Bot. **19**: 275. 1881) was described from a plant cultivated in the Hongkong Botanic Garden. The genus is Polynesian. As the original habitat of this plant is unknown, this genus is not treated here. *Fatsia japonica* (Thunb.) Dcne. & Planch. is also found only in cultivation in China. I have seen only one single fruiting specimen from China: Chekiang, Hangchow, Chi Pan Shan, *Chekiang Univ. LU77622,* in LU.

of Harvard University, have greatly enriched our reference collections and thus added to our knowledge of this family.

The classification of the Araliaceae has been treated by Baillon (1), Seemann (32, 33), Bentham and Hooker (3), Harms (17), and Viguier (36). In the present work, the systematic order of the genera follows that of Harms in Engler and Prantl, Die Natürlichen Pflanzenfamilien (17). Genera described since Harms' work was published are placed in accordance with his general arrangement. In characterizing the accepted genera, the original descriptions and later ones by other authors have been consulted, and these descriptions have been studied in association with extensive collections of Chinese and other Old World material. On account of the lack of sharp and well defined characters, various authors have at times tended to subdivide larger groups, but it is felt that at least some of those who advocate small generic segregates have lacked accessibility to comprehensive collections of reference material. In this treatment, it has been thought desirable to follow generic interpretations as accepted by most modern authors; in other words, I have adopted a conservative attitude. It is to be noted that between closely related genera, such as *Aralia* and *Pentapanax, Brassaiopsis* and *Acanthopanax*, etc., species apparently transitional in nature are often found. In cases of doubt or those of special interest, more or less detailed discussions are given under each species. The descriptions of the species herein presented are based on the original diagnoses, supplementary data provided by later authors, and an actual examination of all available specimens. The generic descriptions, in general, have been limited to the characters presented by the Chinese species.

In connection with this study of the Chinese Araliaceae, I have found the practice of pasting original descriptions and critical notes in the form of clippings or typed data into the herbarium to be extremely useful. It not only saves time in searching for references in widely scattered literature, but also enables one to detect many bibliographical errors by checking the complete series of assembled data regarding a given species. My study was greatly facilitated by having access to the very large amount of published data incorporated in the Britton Herbarium, New York Botanical Garden, and the less extensive assemblage in the herbarium of the Arnold Arboretum. In both institutions this task of inserting published data in the herbarium was initiated by Dr. E. D. Merrill, in 1930 and 1935 respectively. Where this work has been extensively done, the student consulting the herbarium finds a great deal of his needed bibliographical data readily available in juxtaposition with the actual herbarium specimens. For the technique of inserting published data in the herbarium, see Merrill, Jour. Arn. Arb. 18: 173–182. 1937.

In the course of this study, it is found desirable to describe some new species and varieties and to make some new combinations; at the same time I have reduced to synonymy certain species proposed by various authors. One new genus is proposed. The types of the new species and varieties, unless otherwise indicated, are deposited in the Herbarium of the Arnold Arboretum, Harvard University.

It is to be noted that most of the new species are found in Yunnan, with a fair number from Kwangsi. These subtropical regions have been intensively explored only in recent years. Most of the new species are in the genera *Schefflera* and *Dendropanax*, both of which are mainly tropical in distribution. Species of the large and more temperate genera *Acanthopanax* and *Aralia* have been collected more frequently and are fairly well known. The mountainous south-

western parts of China still furnish a wealth of botanical material, with numerous novelties in all major groups of plants. As the floras of the adjacent regions, such as Siam, Burma, and Indo-China are, as yet, imperfectly known, a closer coordination of our knowledge of the elements of these closely related floras is highly desirable for a better understanding of the relationships and geographic distribution of the species occurring within the contiguous areas.

HISTORICAL NOTE

Three genera of the family Araliaceae were recognized by Linnaeus in 1753 (24). They were placed separately, *Aralia* in Pentandria-Pentagynia, *Hedera* in Pentandria-Monogynia, and *Panax* in Polygamia-Dioecia, in the Linnaean system. Ventenat in 1799 (35) first established the Araliaceae as a family, followed by Jussieu in 1816 (22) and D. Don in 1825 (9). DeCandolle (4) monographed the family in 1830, and later Endlicher (12) treated it in 1840 and Decaisne and Planchon (8) in 1854 respectively. From 1864 to 1868, Seemann (32, 33) revised the whole group by recognizing two 'orders,' the Hederaceae, those with flowers having valvate petals, and the Araliaceae, those with flowers having imbricate petals. Later treatments on the classification of the family were by Baillon (1) in 1880, Harms (17) in 1894, and Viguier (36) in 1906. No monographic study of the entire family has been made in recent years.

The first species described from China were *Aralia chinensis* Linn. and *Zanthoxylum trifoliatum* Linn. (the basis of *Acanthopanax trifoliatus* (Linn.) Merr.) published in 1753 (24). Other authors, such as Loureiro (25), Champion (5), Hance (15), Bentham (2), Seemann (32), and others, and later on Franchet (14), Harms (17, 18, 19, 20, 21), and others described many species of Chinese Araliaceae. In 1888, Forbes and Hemsley (13), in their enumeration of Chinese plants, recorded nine genera and twenty-two species of Araliaceae, including one species of the genus *Helwingia,* which is now placed in the family Cornaceae. Since that time a number of new genera and species have been added to the Chinese list as a result of successive botanical explorations in the more remote provinces. In 1924, Chung (6), in his catalogue of Chinese woody plants, listed fourteen genera, seventy-two species, and seven varieties of araliaceous plants. This number has since been increased considerably. Among the more recent authors who have contributed most to our knowledge of the Chinese Araliaceae are Handel-Mazzetti (16), Harms (17, 18, 19, 20, 21), W. W. Smith (34), Rehder (21), Merrill (26, 27, 28), and Chun (28).

GENERAL AND DIAGNOSTIC CHARACTERS

The Araliaceae are for the most part woody plants, *Panax* and some species of *Aralia* being herbaceous. The ligneous representatives vary from low shrubs to tall trees or vines, sometimes climbing by means of aerial roots. Some of them are epiphytic or pseudoepiphytic. The herbaceous species are perennial, with fleshy rootstocks. Some of the herbaceous species of *Aralia* have suffrutescent stems.

Many of the plants are prickly. The length, shape, abundance, and distribution of these prickles are important diagnostic characters. In addition to prickles, the plants may be covered with indumentum ranging from bristles or setose hairs to a well defined tomentum. The hairs may be simple, scaly, furfuraceous, or

more commonly stellate, and in color the indumentum varies from white to brown, ferruginous or red.

The leaves are alternately arranged and are sometimes more or less clustered at the ends of the branchlets. They may be simple and entire or palmately lobed, or digitately or pinnately compound or decompound. There are considerable variations in the size, shape, indumentum, serration, etc., and all are important diagnostic characters for delimiting genera as well as species. The number, prominence, and arrangement of the nerves are useful as specific characters in many cases. Some of the species of *Dendropanax* have characteristic translucent glands in the leaves, which vary in size, color, and distribution. The petioles are generally long and slightly enlarged and thickened at the base. The stipules are either adnate to and scarcely distinguishable from the base of the petiole or prominent, intrapetiolar, and united. They are occasionally absent.

The inflorescence is very important in the classification of the genera as well as species. It may be terminal at the end of long or short branches or axillary. The flowers of most species are arranged in umbels, occasionally in racemes. The umbels or racemes may again be organized into compound umbels or panicles. Some species have sessile flowers compactly arranged in globose heads. The inflorescence is frequently covered with indumentum. The number of flowers in the umbels, the length of the peduncles, the shape and size of the bracts and bracteoles, and the length of the pedicels are useful in differentiating some of the species and varieties. The presence or absence of articulations on the pedicels just below the flowers is an important generic character.

The flowers are regular, commonly very small, and perfect, polygamous, or dioecious. They are mostly 5-merous, but 4-merous and other variations are found. In *Tupidanthus,* the number of certain floral parts is indefinite. The calyx is superior, enclosing the ovary. It is usually short, infundibular or cup-shaped, and glabrous or hairy. The margin may be entire or distinctly or indistinctly dentate. The petals are inserted at the edge of the epigynous disk. They may be valvate or imbricate in the bud, a character that separates the two tribes of the family that are found in China. They are either free or they may cohere at their tips, thus at times being almost calyptrate and falling together. The petal-bases are generally broad, while their tips may be slightly thickened and incurved.

The stamens are generally of the same number as the petals and inserted alternately with them, rarely twice as many as the petals or indefinite in number. The filaments are distinct, short, as long as or sometimes slightly longer than the petals. The anthers are oblong or ovate, introrse, versatile, and consist of 2 locules dehiscing longitudinally.

The ovary is inferior, with one or more cells. The ovules are solitary in each cell, anatropous, and pendulous from the apex. The ovary is crowned by an epigynous disk or stylopodium which is either flattened or hemispherical and confluent with the styles. The styles correspond in number to the cells of the ovary and are distinct or more or less cohering into a column or short cone, rarely absent. The stigmas are simple, insignificant or slightly capitate.

The fruit is a berry or drupe mostly small in size, usually longitudinally ridged and sulcate. The shape, size, number of cells, and other characters are of diagnostic importance. The fruit is frequently crowned by the persistent styles or style-column and by the calyx-teeth. The exocarp is usually fleshy. The endocarp is sometimes hardly distinct from the exocarp or forms distinctly carti-

laginous or membranaceous pyrenes. The seeds are solitary in the pyrenes, inverted, usually laterally compressed, with a minute straight embryo and a fleshy, copious endosperm. The endosperm may be uniform or ruminated, a character of generic value.

SYSTEMATIC POSITION AND SUBDIVISIONS

The family Araliaceae is one of the three of the order Umbelliflorae (Umbellales), which is generally regarded as the most highly specialized group of the Archichlamydeae. This order is characterized by the commonly umbellate inflorescences and the usually small, epigynous flowers, with generally constant numbers of floral parts. The other two families are Umbelliferae and Cornaceae, the latter sometimes split into more than one family. The Araliaceae and Umbelliferae are considered as phylogenetically closely related, while the Cornaceae is not very closely allied to the other two. The Araliaceae differs from the Umbelliferae in that its habit is prevailing woody, the carpels 1–5 or sometimes more, and the fruit a drupe or berry; in the Umbelliferae the plants are all herbaceous, the carpels invariably two in number, and the fruit is a schizocarp.

The Chinese genera of Araliaceae can be arranged in two very clearly distinct tribes, the Schefflereae and the Aralieae. The former has the petals valvate in the bud, and the latter has imbricate petals. A third tribe, the Mackinlayeae, has no representative in China.

RELATIONSHIPS OF THE CHINESE GENERA

Tupidanthus is unique in the Araliaceae and seems to be only remotely related to the other genera. Its primitiveness, however, as indicated by the numerous stamens, ovary-cells, and styles, is unquestionable. By reduction in the number of its floral parts, its ancestral form may have evolved toward such a genus as *Plerandra,* an Indo-Polynesian genus, and thence on to other genera of higher positions.

Among the other genera, *Trevesia* is one of those of a more primitive nature, but in its 7–12-merous flowers it is distinctly more advanced than *Tupidanthus.* Nevertheless, it is still more primitive than the other genera in its more numerous petals, stamens, and ovary-cells. Reduction in the number of floral parts is a definite and clearcut sequence of evolution in this family.

Tetrapanax may be the result of further reduction from *Trevesia.* All of the three genera mentioned, *Tupidanthus, Trevesia,* and *Tetrapanax,* have a uniform endosperm, digitately lobed or palmately compound leaves, inarticulate pedicels, and entirely umbellate flowers.

Schefflera may represent a center of development culminating at this level. This large genus has closely related species, but variations within the genus are already manifest in the several directions that eventually lead to the development of other genera. The number of petals, stamens, and ovary-cells in the Chinese species varies from 5 to 7. The flowers, although mostly in umbels, are sometimes capitate or racemose; where the flowers are umbellate the umbels are often arranged in racemes. The leaves are prevailingly digitately compound in the Chinese species, but in certain extra-Chinese species they may be simple. The endosperm is mostly uniform, but in a few cases slight ruminations are present.

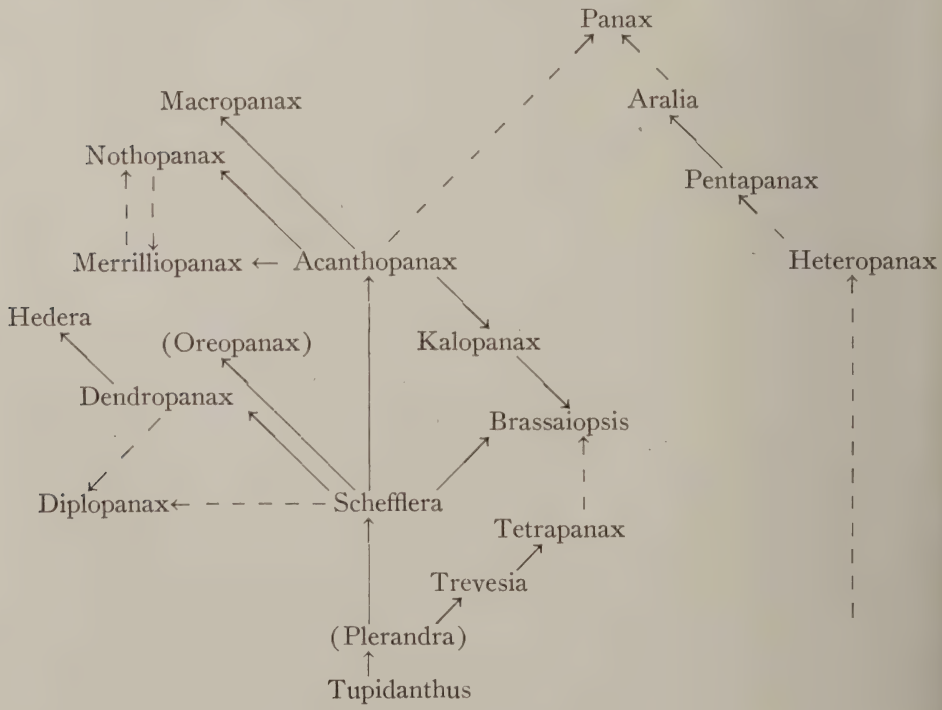
Those species of *Schefflera* with capitate flowers and ruminate endosperm point to the development of such a genus as *Oreopanax.* Those with ruminate

endosperm, by further reduction especially in the number of ovary-cells, may lead to the development of such a genus as *Brassaiopsis,* a group which is also apparently related to certain species of *Acanthopanax.* There may also be relationships between some species of *Brassaiopsis* and *Tetrapanax* and other genera with palmately lobed leaves.

On the other hand, *Dendropanax,* also apparently close to *Schefflera,* may have been evolved from the latter by a reduction of its vegetative parts, as it always has strictly simple leaves. *Hedera* is apparently derived from *Dendropanax,* but is more specialized in its climbing habit, often dimorphous leaves, and ruminate endosperm. The true alliances of *Diplopanax* are somewhat doubtful, as its single-celled ovaries, spicate inflorescences, and unique fruits are all outstanding and indicate little relationship to the other genera discussed. It is apparently closer to *Dendropanax* or perhaps *Schefflera* than any of the other genera.

Acanthopanax is another large group that may have been a center from which other genera have been derived. It represents a higher level than *Schefflera,* as evidenced by its smaller number of floral parts and the slight articulation of the pedicels in certain species. The genus is heterogeneous and may ultimately require certain segregations.

Some species of *Acanthopanax* are apparently related to *Brassaiopsis,* particularly those species with a reduced number of ovary-cells. The articulation of the pedicels is further developed in *Nothopanax* and *Macropanax,* the latter being further specialized by its ruminate endosperm. *Merrilliopanax* may represent another line of specialization from *Acanthopanax,* particularly in the direction of *Nothopanax. Kalopanax,* which has been included in *Acanthopanax* by some authors, is unquestionably closely related to the latter. It is, however, possibly equally close to *Brassaiopsis,* for some species of *Brassaiopsis* may have been



derived from *Acanthopanax* through *Kalopanax*, while other species may have been derived from *Schefflera*.

The different genera so far discussed are all members of the tribe Schefflereae, characterized by having valvate petals. They bear either simple or palmately lobed or digitately compound leaves. *Heteropanax*, however, differs from all others in having pinnately compound or decompound leaves. In floral characters, it is close to *Brassaiopsis* and *Macropanax*. It may represent a highly specialized line derived out of some genera with pinnately lobed leaves, that are not at present represented in China.

The tribe Aralieae has imbricate petals and evidently represents a higher development than the tribe Schefflereae, as evidenced by the herbaceous habit in some of the species. *Pentapanax* is even more primitive than *Aralia*, as may be judged by its prevailingly woody habit and generally more numerous ovary-cells. *Panax* is entirely herbaceous and represents a more specialized development. Its digitately compound leaves, however, indicate little relationship with the other two genera with pinnately compound leaves and it may even be remotely connected with *Acanthopanax* or other genera of the tribe Schefflereae.

A schematic representation of the relationships of the Chinese genera is presented on p. 6 to summarize the above discussion. The extra-Chinese genera mentioned are indicated by their names being in parentheses. Solid lines indicate more definite relationships, while broken lines indicate doubtful ones. Arrows are used to show probable directions of evolution.

GEOGRAPHICAL DISTRIBUTION

The family Araliaceae is mainly tropical, with very few of its genera extending to the north. In China the maximum development is in the southwest, with the province Yunnan yielding over half of all the known Chinese species. It is well represented in all the southern provinces, with 30° N. as the northern boundary of most of its genera. Among the seventeen genera known to occur in China, only five, *Acanthopanax, Kalopanax, Aralia, Hedera,* and *Panax,* have species that extend to the Yellow River Valley or occasionally even as far north as Manchuria. The distribution of the different genera may be summarized briefly as follows:

1. *Tupidanthus.* This monotypic genus is found in India and Burma. In China it is known from Yunnan only.
2. *Trevesia.* The one species and variety of this genus found in southwestern China occur in the provinces Yunnan and Kweichow. This genus is widespread in tropical Asia.
3. *Tetrapanax.* A single species of this genus occurs in southern and western China, in the provinces Hunan, Szechuan, Yunnan, Kweichow, Kwangsi, and Kwangtung. It has also been recorded by other authors from Anhwei and Hupeh. Outside of China it occurs in Formosa only.
4. *Schefflera.* This large genus is common to the warmer parts of both hemispheres. Twenty-eight species and two varieties are recorded in the present study. Yunnan is the chief center of occurrence in China, with twenty-two species. From five to seven species are found in each of the provinces Kweichow, Kwangsi, and Kwangtung, and one to three in Chekiang, Fukien, Hainan, Kiangsi, Szechuan, and Sikang.
5. *Diplopanax.* This recently established monotypic genus is endemic in Kwangsi.

6. *Dendropanax.* This genus is common to the tropical regions of Asia and America, a few species extending beyond the tropics. It is essentially tropical and southern in China. Of the thirteen species and one variety found in China, eleven are recorded from Kwangsi, nine from Kwangtung, three from Hainan, and three from Kweichow. One or two are found in each of the following provinces: Fukien, Yunnan, Szechuan, Hunan, Kiangsi, Anhwei, and Chekiang. In China this genus extends to about 30° N., but it occurs north of this in Korea and Japan.

7. *Hedera.* This genus is found in Asia, Europe, and North Africa. The one variety found in China is fairly widespread. It is found mainly in western China from Kansu and Shensi in the north to Yunnan in the south and along the Yangtze Valley in central and eastern China.

8. *Brassaiopsis.* This is a tropical genus which extends from India to Malaysia. In China it is entirely confined to the southwestern part of the country. Of the thirteen species, almost all are found in Yunnan, while a few extend to the neighboring provinces, such as Szechuan, Kweichow, Kwangsi, and Hainan.

9. *Macropanax.* The two species of *Macropanax* are mainly characteristic of India. In China they are found in Yunnan and Hainan only.

10. *Merrilliopanax.* This new genus contains two species. One of them is common to northeastern India and Yunnan. The other is known from a single Yunnan collection.

11. *Nothopanax.* This genus is chiefly Australian. The three Chinese species are localized in the southwest, mainly in Yunnan, but the group is also represented in Hupeh, Szechuan, Sikang, and Kweichow.

12. *Acanthopanax.* This large eastern Asiatic and Himalayan genus is distinctly temperate in distribution and is well represented in all parts of China. It is found in all provinces from Manchuria south to Hainan Island, with the maximum development along the Yangtze Valley. Twenty-two species, twelve varieties, and three forms are recorded in this study. These are more or less evenly distributed throughout the different provinces. Ten or more are found in both Yunnan and Szechuan (including Sikang). About five species and varieties are found in each of the following provinces: Shensi, Kansu, Hopei, Chekiang, Anhwei, Kiangsi, Kwangsi, Kwangtung, and Kweichow. The other provinces have from one to three each.

13. *Kalopanax.* The single species (with two varieties) of this genus is widespread in China. Records are found in all provinces from Manchuria to Kwangtung except Hainan and Kwangsi in the south and Kansu and Shensi in the north. It also occurs in Japan.

14. *Heteropanax.* The three species and two varieties so far known in this genus are found in the southern provinces, Kiangsi, Yunnan, Kwangsi, Kwangtung, and Hainan. The genus is southern Asiatic in distribution.

15. *Pentapanax.* This genus occurs in southern Asia, Australia, and in tropical America. Seven species and one or two varieties are known in China. They are all confined to Yunnan except one or two from Szechuan, Sikang, and Anhwei.

16. *Aralia.* This large genus is characteristic of the temperate and tropical regions of Asia and America. Twenty species and two varieties are known in China. The genus is widely distributed all over China from Manchuria to Hainan. The species are especially well dispersed in the provinces along the Yangtze River and south to it. The maximum development is in Yunnan, Kwangtung, and Kwangsi.

17. *Panax.* This genus is found in the temperate regions of eastern Asia and North America. Of the two species known in China, one is probably confined to Manchuria, while the other, with its several varieties, is found mainly in southern, western, and central China.

ECONOMIC USES

The family Araliaceae yields a number of important drug plants. The ginseng, *Panax schin-seng* Nees, is a very famous Chinese tonic. The root bark of *Acanthopanax gracilistylus* W. W. Smith, its varieties, and possibly some of the related species, known as *wu-chia-pi,* is used in making a well known medicinal wine. The root of *Aralia cordata* Thunb., and the stems, leaves, and fruits of *Hedera nepalensis* var. *chinensis* Rehder are also used in Chinese medicine. The pith of *Tetrapanax papyriferus* Koch produces the rice paper, *tung-tsao,* which is used in medicine and is very extensively employed in making artificial flowers and for other purposes of decoration.

A number of timber trees are found in this family. *Kalopanax pictus* (Thunb.) Nakai is an important timber tree in China. It is widely scattered and common throughout most parts of China. A few species, such as *Schefflera octophylla* Harms, produce lumber that is used for making furniture and for other purposes. Many shrubs, particularly those of the genera *Acanthopanax, Nothopanax,* and *Aralia,* are valued as ornamentals.

NOMENCLATURE AND CITATIONS

In this treatment, *Panax* and all *Panax* compounds are treated as masculine, as this is provided for specifically in the last edition of the International Rules of Botanical Nomenclature. *Panax* classically is masculine, but Linnaeus (24) used it as neuter. Most botanists did the same until Franchet in 1886 and Harms in 1894 (17) consistently used the masculine form for *Panax* and all the *Panax* compounds; this latter usage is correct and should be universally adopted.

The citations of specimens at the end of the descriptions are given in chronological order. The dates of the specimens cited are omitted to conserve space. Series numbered by institutions are cited after the collector whenever the collector is indicated on the labels. Geographic subdivisions are based on provinces, with Hainan separated from Kwangtung. They are generally given in the following order: Kansu, Shensi, Shansi, Honan, Hopei, Jehol, Manchuria, Shangtung, Kiangsu, Chekiang, Anhwei, Kiangsi, Hunan, Hupeh, Szechuan, Sikang, Tibet, Yunnan, Kweichow, Kwangsi, Kwangtung, Hainan, and Fukien, beginning from the northwest along the Yellow River, extending to the east and then along the Yangtze River to the west and finally along the Pearl River, ending in the southeast. In this sequence phytogeographically related provinces are generally held together. Precise localities are given according to what data are available in the field notes. However, no attempt is made to standardize the local place names, as Chinese characters are mostly not available. Sikang, recently established as a province, was formed from the special District of Sikang and parts of western Szechuan. In many instances it has been considered expedient to enumerate plants from Sikang and Szechuan together, as from the place names originally given in the field notes it is often difficult or impossible to make out their exact locations according to the new provincial boundaries. Some doubt may thus be

found in places quoted as southeastern Tibet, western Szechuan, and northern Yunnan.

Abbreviations used in designating the herbaria in which cited specimens are deposited are as follows:

AA	Arnold Arboretum of Harvard University.
CCC	Canton Christian College = Lingnan University.
G	Gray Herbarium of Harvard University.
LU	Lingnan University.
NY	Britton Herbarium, New York Botanical Garden.
UN	University of Nanking.
W	United States National Herbarium.

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ARALIACEAE

Calyx-tube adnate to the ovary, the margin undulate or denticulate. Petals 5–10, valvate or imbricate, usually free, sometimes connate or calyptrate. Stamens usually as many as the petals and alternate with them, or twice as many as the petals, or indefinite, inserted with the petals at the edge of the disk, the filaments filiform or ligulate, the anthers oblong or ovate, versatile, introrse, the locules 2, longitudinally dehiscent. Disk epigynous, fleshy, shortly conical or annular. Ovary inferior, 1–15-celled, the styles as many as the locules, sometimes distinct, usually partly or wholly connate into a column or short cone, the stigmas terminal, the styles occasionally suppressed, the stigmas sessile on the tip of the ovary. Ovules solitary, pendulous from the apex of each cell, anatropous. Fruit baccate or drupaceous, the exocarp usually fleshy, the endocarp forming distinct cartilaginous or membranaceous pyrenes or hardly distinct from the exocarp. Seeds solitary in pyrenes, usually laterally compressed, endospermic, with small embryo, the endosperm uniform or ruminated.

Perennial herbs or shrubs or trees, often prickly, sometimes scandent. Leaves alternate, petiolate, simple or pinnately compound or decompound or digitately compound. Stipules adnate to the petioles, often connate into a sheath, sometimes hardly distinct or wanting. Flowers regular, mostly small, hermaphrodite, polygamous, or dioecious, usually in umbels or heads, rarely racemose or spicate,

the umbels or heads solitary, racemose, corymbose, paniculate, or umbellate. Bracts subtending the branches of inflorescence small, deciduous or persistent. Bracteoles at the base of the pedicels small, usually inconspicuous. Pedicels continuous with calyx or articulate under the flower.

About 60 genera and more than 800 species in the tropical and temperate regions of both hemispheres. Seventeen genera and about 120 species are found in China.

Key to the Chinese Genera

A. Petals valvate in the bud. (Tribe I. Schefflereae Harms.)
B. Stamens very numerous, often 50–70, ovary-cells indefinite .....1. *Tupidanthus.*
BB. Stamens 10 or fewer, ovary-cells definite, 1–12.
C. Ovary 4–12-celled.
D. Leaves simple or pinnately lobed.
E. Ovary 7–12-celled; petals and stamens 7–12; styles united into a short column; leaves pinnately 5–9-lobed .....2. *Trevesia.*
EE. Ovary 5-celled; petals and stamens 5–12; styles more or less distinct; leaves generally simple, sometimes palmately 2–3-lobed.
F. Erect shrubs; leaves often with characteristic transluscent glands; endosperm uniform .....6. *Dendropanax.*
FF. Woody vines climbing by means of aerial roots; leaves without glands; endosperm ruminate .....7. *Hedera.*
DD. Leaves digitately compound.
E. Unarmed; ovary 5–7-celled, styles united into a column or stigmas sessile. 4. *Schefflera.*
EE. Prickly, rarely unarmed; ovary 2-, occasionally 3–5-celled, styles 2–5, distinct or connate at the base .....12. *Acanthopanax.*
CC. Ovary 1–2-celled, seldom 3-celled.
D. Ovary 1-celled; stamens 10; leaves simple .....5. *Diplopanax.*
DD. Ovary 2–3-celled; stamens mostly 4–5; leaves simple or compound.
E. Leaves simple or palmately lobed or digitately compound.
F. Leaves simple or palmately lobed.
G. Armed or unarmed trees, rarely shrubs; styles united into a column.
H. Armed trees; flowers perfect; endosperm uniform .....13. *Kalopanax.*
HH. Armed or unarmed trees or shrubs; flowers mostly polygamous; endosperm uniform or ruminate .....8. *Brassaiopsis.*
GG. Unarmed shrubs; styles distinct or slightly connate at the base.
H. Leaves palmately 7–12-lobed .....3. *Tetrapanax.*
HH. Leaves not lobed, or, if so, the lobes 2–5 only.
I. Simple and lobed and digitately 3–5-foliolate leaves often present on the same plant; pedicels distinctly articulate; fruits mostly flattened. 11. *Nothopanax.*
II. Leaves not lobed or only shallowly 3-lobed; pedicels inarticulate; fruits subglobose .....10. *Merrilliopanax.*
FF. Leaves digitately compound.
G. Unarmed shrubs; pedicels distinctly articulate under the flower.
H. Styles distinct or connate at base; fruit often flattened; endosperm uniform .....11. *Nothopanax.*
HH. Styles united into a column; fruit ovoid, ribbed; endosperm ruminate. 9. *Macropanax.*
GG. Prickly or rarely unarmed shrubs; pedicels inarticulate or only very obscurely jointed.
H. Umbels in large compound panicles; flowers mostly polygamous; styles united into a column; endosperm uniform or ruminate ...8. *Brassaiopsis.*
HH. Umbels solitary or few together or forming large terminal panicles; flowers perfect or polygamous; styles distinct or connate at the base only; endosperm uniform .....12. *Acanthopanax.*
EE. Leaves pinnately compound or decompound .....14. *Heteropanax.*

AA. Petals imbricate in the bud. (Tribe II. Aralieae Harms.)
B. Herbaceous or woody plants; leaves pinnately compound or decompound; styles 2–5.
C. Herbs, shrubs, or small trees; leaves 1–3-pinnate; flowers umbellate; ovary 2–5-celled, the styles 2–5, distinct .....16. *Aralia*.
CC. Trees or large scandent shrubs; leaves 1-pinnate; flowers racemose or umbellate; ovary 5-, sometimes 7–8-celled, the styles 5, more or less united ....15. *Pentapanax*.
BB. Herbs; leaves digitately compound; ovary 2-, sometimes 3-celled, the styles 2 or 3, distinct .....17. *Panax*.

I. Tupidanthus Hooker f. & Thomson

Tupidanthus Hooker f. & Thomson, Bot. Mag. **82**: *t. 4908*. 1856.

A glabrous shrub, at first erect, afterwards a lofty climber. Leaves large, digitately compound, the leaflets glabrous, entire, coriaceous, petiolulate, the stipules connate within the petioles. Flowers large, umbellate, the umbels few-flowered, arranged in a compound umbel or small panicle, the pedicels thick, not articulate under the flower. Calyx margin obsolete. Petals closely connate into a calyptra, early deciduous. Stamens very many, in two or more series, the anthers oval-oblong. Ovary many-celled. Fruit drupaceous, globose, depressed, leathery-fleshy; seeds numerous; endosperm uniform.

One species in tropical Asia, extending from India to southwestern China and Indo-China.

1. **Tupidanthus calyptratus** Hook. f. & Th. Bot. Mag. **82**: *t. 4908*. 1856; Seem. Jour. Bot. **2**: 240. 1864, Revis. Heder. 6. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 740. 1879; Hemsl. Jour. Linn. Soc. Bot. **34**: 476. 1900; Lévl. Cat. Pl. Yun-Nan 11. 1915; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1170. *f. 139. no. 1, 2, 3*. 1923; Chung, Mem. Sci. Soc. China **1**: 185. 1924.

A scandent woody plant, 15–30 m. tall, with 7–9-foliolate leaves, the leaflets obovate or oblong-lanceolate, entire, the flowers in umbels of 3–7 flowers each, forming a small panicle or compound umbel with very stout pedicels. Leaves petiolate, stipulate; petioles terete, glabrous, 12–35 cm. long; stipules connate within the petiole, forming a short sheath; leaflets coriaceous, petiolulate, 12–20 cm. long, 4–8 cm. wide, glabrous on both surfaces, the apex shortly acuminate, the base attenuate, the margins entire, the lateral nerves 20–30 or more on both sides, oblique, distinct on both surfaces; petiolules 3–5 cm. long. Inflorescence terminal, the flowers arranged in umbels forming a small panicle or an irregularly branched compound umbel, the main umbel about 3-branched, the branches 6–8 cm. long, very stout, with large, ovate, coriaceous bracts at the base, 1.5 cm. long, the umbels 3–7-flowered, the pedicels stout, glabrous, 2–3 cm. long, the flowers 1.5–3 cm. across. Calyx-tube coriaceous, glabrous, indistinctly dentate. Petals forming a calyptra, early deciduous. Stamens very numerous, about 50–70, crowded, the filaments thick, 3 mm. long. Ovary many-celled, the stigmas very many, sessile, radiating, fusing to form a connate longitudinal or sometimes 3-rayed stylar tract along the disk, its branches usually appearing cleft at the ends. Disk broad, flat, obscurely lobed, depressed in the center. Fruit globose, depressed, 2.5–3.5 cm. across.

Yunnan: Szemao, *Henry 12298* (AA, NY), *12298A* (W), and *12298B* (NY); between Ban Man To and Szemao, *J. F. Rock 2757* (AA, W); Tsang Yuan, *C. W. Wang 73240* (AA); Fo-hai Hsien, *C. W. Wang 73932* (AA); Nan Chiao, *C. W. Wang 75228* (AA); Fo-hai Hsien, Meng-ban, Shan-shien, *C. W. Wang 76202* (AA).

Additional Distribution: India, Burma, and Indo-China.

II. Trevesia Visiani

Trevesia Vis. in Giorn. Tosc. Sci. Med. Fis. Nat. **1**: 72. 1840, Mem. Accad. Torin II. **4**: 262. 1842.

Shrubs or small trees, prickly or unarmed, glabrous or stellate-tomentose. Leaves large, palmately lobed or digitately compound, the leaflets long-petiolulate

with free blades, the petiolules often united within a foliaceous expansion at the apex of the petiole, the stipules connate within the petiole bases or obsolete. Flowers in umbels, the umbels paniculate, the bracts small, persistent or deciduous, the pedicels not articulate under the flower. Petals 7–12, valvate, thickish, often united to form an early deciduous calyptra. Stamens as many as the petals, the anthers oval. Ovary 7–12-celled, the styles united into a short column. Fruit ovoid; seeds compressed; endosperm uniform.

Two species extending from Eastern India to Malaya and Polynesia.

Type species: *Trevesia palmata* (Roxb.) Vis. (*Gastonia palmata* Roxb.).

1. **Trevesia palmata** (Roxb.) Vis. Mem. Accad. Torin II. **4**: 262. 1842; Seem. Jour. Bot. **5**: 286. 1867, Revis. Heder. 77. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 732. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 502. 1911; Diels, Notes Bot. Gard. Edinb. **7**: 78. 1912; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1180. *f. 140.* 1923; Chung, Mem. Sci. Soc. China **1**: 185. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 11, 397. 1929–30; Rehder, Jour. Arn. Arb. **15**: 113. 1934; Chun, Sunyatsenia **4**: 247. 1940.

Gastonia palmata Roxb. Hort. Bengal. 33, *nomen nudum.* 1814, Fl. Ind. **2**: 407. 1824; Lindl. Bot. Reg. **11**: *t. 894.* 1825.

Gilibertia palmata DC. Prodr. **4**: 256. 1830.

Fatsia Cavalerieri Lévl. Bull. Acad. Géogr. Bot. **24**: 144. 1914, Fl. Kouy-Tchéou 34. 1914.

A slender tree, 3–5 m. tall, with large, deeply palmately 5–9-lobed leaves, the lobes serrate or again lobed, the flowers in umbels forming large panicles. Branches prickly and tomentose. Leaves large, petiolate, stipulate, about 30–45 cm. across, coriaceous, glabrous or with scattered stellate hairs on both surfaces, in young plants often digitately compound, the lobes lanceolate, acuminate, serrate or again lobed, the lateral nerves distinct on both surfaces, the tertiary nerves obscure above, the petiolules when present with an entire wing; petioles often prickly, 30–45 cm. long; stipules united into a 2-lobed sheath within the petioles. Inflorescence in panicles, 45 cm. long, ferruginous-tomentose when young, the lower branches compound, the bracts oblong, obtuse, 2.5 cm. long, caducous; flowers in many-flowered umbels 4.5 cm. across, the peduncles 4–9 cm. long, the pedicels 1.5–2 cm. long. Calyx ferruginous-tomentose, 4 mm. long, the margin inconspicuously 10-dentate. Petals 6–10, 5 mm. long, slightly tomentose outside. Stamens 6–10, the filaments 5 mm. long. Ovary 8–10-celled, the disk flattened, the styles coalescing into a grooved cone, the stigmas bluntly toothed. Fruit subglobose, 1 cm. across, glabrate, the ribs not prominent, the style-cone persistent, stout, 4 mm. long.

YUNNAN: Szemao, *Henry 11757* (AA, NY, W); between Muang Pan and Muang Hun, *J. F. Rock 2395* (AA, W), *2398* (AA, W); between Muang Hun and Muang Hai, *J. F. Rock 2402* (AA, W); between Hsinfu and Kuan-ni, *J. F. Rock 2949* (AA, W); Fo Hai, *C. W. Wang 74910* (AA); Lan-tsung Hsien, *C. W. Wang 76594* (AA), *76744* (AA); Shunning, Lomawe, *T. T. Yü 15899* (AA).

KWEICHOW: Houa-kiang, *J. Cavalerie 2144* (holotype of *Fatsia Cavaleriei* Lévl,, photo. and merotype, AA).

ADDITIONAL DISTRIBUTION: India.

The leaves are variable in size and shape. C. B. Clarke (in Hook. f. Fl. Brit. Ind. 2: 732. 1879) distinguishes the form with palmate leaves and entire-winged petiolules as var. *cheirantha,* which is also recorded from China by Hemsley (Jour. Linn. Soc. Bot. **34**: 476. 1899). *Rock 2402* and *Wang 76594* are intermediate in the general shape of the leaves between the variety, represented by such specimens as *Henry 11757* and *Wang 76744,* and the typical form. Thus the status of Clarke's trinomial is questionable and his variety is not accepted as appertaining to Chinese forms. The material from Kweichow has the leaves generally smaller, more coriaceous, and with margins more lobulate than those of the specimens from other regions.

1a. **Trevesia palmata** var. **costata** var. nov.

A typo praecipue fructu valde 10-costato differt.

A low shrub. Leaves large, long-petiolate, stipulate, to 60 cm. across, palmately 7–9-lobed, coriaceous, glabrous or scattered-stellate-tomentose on both surfaces, the lobes oblong-lanceolate, acute, serrate, the lateral nerves distinct on both surfaces, the tertiary nerves obscure above; petioles 60 cm. or more long, terete, grooved, with occasional scattered prickles; stipules united into a 2-lobed sheath within the petiole. Inflorescence and flower unknown. Fruit subglobose, glabrate, 5 cm. across, prominently 10-ribbed, 10-seeded, the seeds laterally compressed, the style persistent, stout, 2 mm. long.

YUNNAN: Lan-tsang Hsien, *C. W. Wang 76520* (AA); Fo Hai, *C. W. Wang 76004A* (TYPE, AA); Che-li Hsien, Dah-meng-lung, *C. W. Wang 77895* (AA).

Differs from the typical form primarily in the prominently ribbed fruit. With better material it may prove to be worthy of specific rank.

III. TETRAPANAX K. Koch

Tetrapanax K. Koch, Wochenschr. Gärtn. Pflanzenk. **2**: 371. 1859.

Unarmed, stoloniferous shrubs. Leaves large, long-petiolate, palmately lobed, the lobes acute, serrate, stellate-ferruginous-tomentose beneath, the stipules 2, awl-shaped, prominent. Flowers in umbels, the umbels in large terminal panicles, the pedicels not articulated under the flowers. Calyx-margin obsolete. Petals 4–5, ovate, acute, valvate. Stamens 4–5, the filaments elongate, the anthers elliptic-ovate. Styles 2, erect, recurved at their tips. Ovary 2-celled, the cells 1-ovulate. Fruit baccate, drupaceous.

One species in southern China and Formosa.

1. **Tetrapanax papyriferus** (Hook.) K. Koch, Wochenschr. Gärtn. Pflanzenk. **2**: 371. 1859; Seem. Jour. Bot. **6**: 58. 1868, Revis. Heder. 88. 1868; Harms ex Diels, Bot. Jahrb. **29**: 486. 1900; Chung, Mem. Sci. Soc. China **1**: 186. 1924; Hand.-Maz. Symb. Sin. **7**: 690. 1933; Rehder, Jour. Arn. Arb. **15**: 113. 1934; Merr. & Chun, Sunyatsenia **2**: 13. 1934.

   Aralia papyrifera Hook. Jour. Bot. Kew Gard. Misc. **4**: 53. *t. 1, 2.* 1852; Curtis Bot. Mag. **82**: *t. 4897.* 1856.

   Fatsia papyrifera Benth. & Hook. f. ex Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 341. 1888; Lévl. Fl. Kouy-Tchéou 34. 1914, Cat. Pl. Yun-Nan 11. 1915; Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933.

   Aralia Mairei Lévl. Rep. Spec. Nov. **13**: 342. 1914, Fl. Kouy-Tchéou 34. 1914, Cat. Pl. Yun-Nan 11. 1915.

A shrub 1–2 m. tall, with large, palmately 7–12-lobed leaves and large, terminal, compound, densely tomentose panicles of umbels. Leaves long-petioled, stipulate, to 50 cm. or more across, chartaceous to subcoriaceous, glabrous above, densely stellate-ferruginous-tomentose beneath, the lobes 7–12, free to the lower ⅓ the length of the blade, ovate-oblong, the apex acuminate, the margins entire to coarsely toothed, the lateral nerves oblique, distinct on both surfaces, the tertiary nerves slightly impressed above; stipules 2, awl-shaped, acuminate, prominent, united at base within the petioles; petioles long, terete, glabrous, to 50 cm. or more long. Inflorescence a large terminal compound panicle, to 50 cm. long, densely tomentose, the branches ascending, 20 cm. long, the bracts elongate, acuminate, 2 cm. long, the flowers yellowish white, in umbels, the umbels many-flowered, 12 cm. in diameter, the peduncles 1.2 cm. long, the bracteoles linear, 1.2 cm. long, 2 mm. wide; pedicels 4 mm. long. Calyx densely tomentose, 1 mm. long, the margin obsolete. Petals 4–5, 2 mm. long, tomentose outside, separate or united to form an early deciduous calyptra. Stamens 4–5, the filaments 3 mm. long. Ovary 2-celled, the styles 2, distinct, erect, recurved at the tip. Fruit a drupe.

HUNAN: Tschangscha, *Handel-Mazzetti 459* (AA).
SZECHUAN: Pechuan Hsien, *W. P. Fang 5567* (AA); Pachow Fu, *F. T. Wang 22674* (AA); O-pien Hsien, *Y. S. Liu 2262* (AA).
YUNNAN: Mentze, *Henry 11358* (AA, NY, W); Valley of Liu-Kiang, *E. E. Maire* (holotype of *Aralia Mairei* Lévl., photo. in AA).
KWEICHOW: Ta Ho Yen, Fan Chin Shan, *Steward, Chiao, & Cheo 740* (AA, NY).
KWANGSI: Yung Hsien, Ta Tze Tseun, *Steward & Cheo 1200* (AA).
KWANGTUNG: Ying Tak, Wan Tong Shan, Tai Tsan, *W. T. Tsang & K. C. Wong 2980 = LU 14841* (LU); Lokchong, *N. K. Chun 41948* (NY), *42295* (NY); Kook Kiang, Yao Shan, *C. Wang 31548* (AA, NY).
ADDITIONAL DISTRIBUTION: Formosa.

IV. SCHEFFLERA J. R. & G. Forster

Schefflera J. R. & G. Forst. Char. Gen. 45. *t. 23.* 1775.
Sciodaphyllum P. Br. Hist. Jam. 190. *t. 19. f. 1, 2.* 1756.
Agalma Miq. Fl. Ind. Bat. 1(1): 752. *t. 11.* 1855.
Heptapleurum Gaertn. Fruct. 2: 472. *t. 178.* 1791.

Shrubs or trees, often subscandent, glabrous or tomentose, unarmed. Leaves digitately compound (in our species), the stipules connate within the petiole. Flowers in umbels, racemes, or globose heads, these arranged in panicles or compound racemes, the bracts hairy, deciduous or persistent, the pedicels not articulated under the flower. Calyx-margin entire or 5-dentate. Petals 5–7, valvate. Stamens as many as petals, the anthers ovate. Ovary 5–7-celled, rarely less. Styles united into a column or none, the stigmas distinct, sometimes sessile. Fruit globose or ovoid, 5–7-seeded, angled or not; seeds laterally compressed; endosperm uniform or slightly ruminated.

Between 300 and 400 species widely distributed in the tropics of both hemispheres.

Type species: *Schefflera digitata* J. R. & G. Forst. of New Zealand.

The name *Schefflera* is now generally accepted by most authors for species of both the Old and New World tropics. While some authors continue to retain some of the subdivisions, such as *Heptapleurum* Gaertn., as of generic rank, the characters are such that for practical purposes it seems best to retain *Schefflera* in the wider sense. Attention is called to the fact that *Sciodaphyllum* P. Br. is the oldest valid name for this group, it having been based on specimens from Jamaica. Since it seems to be desirable to unite all species in a single more or less collective group, the name *Schefflera* should be conserved, as it is very well known and extensively used. For a consideration of the matter, see A. C. Smith, Trop. Woods 66: 3. 1941.

KEY TO SPECIES AND VARIETIES

A. Flowers sessile or short-pedicellate, arranged in compact heads. (Section I. *Cephalo-schefflera* Harms.)
  B. Leaflets 6, broadest below the middle, the margins entire or sparingly serrulate, the tertiary nerves inconspicuous beneath; heads arranged in a panicle ....1. *S. chinensis.*
  BB. Leaflets 7, generally broadest above the middle, the margins entire, the tertiary veins conspicuous beneath; heads arranged in a raceme .....2. *S. Wangii.*
AA. Flowers more or less long-pedicellate, arranged in racemes or umbels. (Section II. *Euschefflera* Harms.)
  B. Styles connate into a long or short cylindric column, always evident. (Subsection I. *Agalma* Harms.)
    C. Flowers in umbels, the umbels in racemes or panicles.
      D. Styles connate below, radiate above, their tips reflexed .....3. *S. hypoleucoides.*
      DD. Styles connate into a column throughout their whole length.
        E. Style-column very short, less than 1 mm. long in fruit .....4. *S. octophylla.*
        EE. Style-column exceeding 1 mm. in fruit.

F. Inflorescence small, less than 15 cm. long; leaflets linear-lanceolate, membranaceous .....5. *S. Bodinieri.*
FF. Inflorescence large, 30–40 cm. or more long; leaflets ovate to lanceolate, chartaceous to coriaceous.
G. Leaflets large, 20–55 cm. × 8–25 cm. .....6. *S. macrophylla.*
GG. Leaves small, the leaflets less than 20 cm. long and 8 cm. wide.
H. Petiolules subequal in length, 1–3.5 cm. long.
I. Leaflets with tertiary veins more or less impressed above.
J. Leaflets oblanceolate to lanceolate, the tertiary veins deeply impressed above .....7. *S. impressa.*
JJ. Leaflets ovate-lanceolate, the tertiary veins slightly impressed above. 8. *S. producta.*
II. Leaflets with tertiary veins projecting above .....9. *S. elata.*
HH. Petiolules very unequal in length, 1–9 cm. long.
I. Leaflets minutely stellate-tomentose beneath .....10. *S. minutistellata.*
II. Leaflets with scattered loosely stellate-tomentose hairs or glaucous beneath .....11. *S. hypoleuca.*
CC. Flowers in simple racemes or paniculate, never arranged in umbels.
D. Leaflets many, generally 12–16.
E. Leaflets about 16, large, 8–15 cm. × 2–8 cm., the veins projecting above. 12. *S. hainanensis.*
EE. Leaflets fewer than 16, small, 4–10 cm. × 2–4 cm., the veins impressed above. 13. *S. Metcalfiana.*
DD. Leaflets few, generally 5–7.
E. Leaflets more or less pubescent beneath.
F. Leaflets minutely and distinctly stellate-pubescent beneath, unequal in size, the margins strictly entire .....14. *S. diversifoliolata.*
FF. Leaflets densely or rather coarsely stellate-pubescent beneath, more or less equal in size, entire or toothed.
G. Flowers sessile, the petals glabrous without; veins not impressed above, the reticulum beneath usually obscured by the very dense indumentum.
H. Indumentum white .....15. *S. Delavayi.*
HH. Indumentum brown .....15a. *S. Delavayi* var. *ochraceum.*
GG. Flowers pedicellate, the petals densely tomentose without; veins impressed above, the reticulum very prominent beneath, not at all obscured by the somewhat scattered indumentum .....16. *S. Wardii.*
EE. Leaflets glabrous.
F. Petiolules short, mostly 1 cm. long or less, rarely 1.3 cm. long. 17. *S. shweliensis.*
FF. Petiolules mostly 1.5 cm. or longer.
G. Leaflets narrowly oblong to lanceolate, the lateral nerves 12–20 on each side.
H. Leaflets 15–17 cm. × 5–5.5 cm., the lateral nerves 16–22, oblique. 18. *S. multinervia.*
HH. Leaflets 15–24 cm. × 4–5 cm., the lateral nerves 12–20, ascending. 19. *S. dumicola.*
GG. Leaflets oblong to oblanceolate, the lateral nerves 8–12 on each side.
H. Leaflets small, 15 × 7 cm. or less .....20. *S. Hoi.*
HH. Leaflets large, 30 × 10 cm. .....20a. *S. Hoi* var. *macrophylla.*
BB. Styles none, the stigmas sessile. (Subsection II. *Heptapleurum* Harms.)
C. Flowers sessile or subsessile .....21. *S. glomerulata.*
CC. Flowers distinctly pedicellate.
D. Leaflets oblong to obovate, broadest above the middle.
E. Leaflets 2–5, very slenderly caudate-acuminate, the acumen up to 2.5 cm. long, more or less falcate .....22. *S. tenuis.*
EE. Leaflets 5 or more, obtuse to short-acuminate.
F. Leaflets 5–6, short-acuminate, 5.5 × 3 cm., the petioles short, 5–6 cm. long. 23. *S. yunnanensis.*
FF. Leaflets 7–9, obtuse to acute, 9 × 4 cm., the petioles long, 12–15 cm. 24. *S. arboricola.*
DD. Leaflets elliptic to oblong, not broadest above the middle.
E. Leaflets oblong-lanceolate, acuminate, three times as long as broad; a low shrub. 25. *S. kwangsiensis.*

EE. Leaflets elliptic to oblong, obtuse to acuminate, 1½ to 2½ times as long as broad; shrubs or trees.
F. Leaflets three ..... 26. *S. fukienensis.*
FF. Leaflets 5–7.
G. Fruits ovoid, distinctly 5-angular, the disk conical ..... 27. *S. venulosa.*
GG. Fruits globose, indistinctly 5-angular, the disk depressed-conical. 28. *S. khasiana.*

1. **Schefflera chinensis** (Dunn) comb. nov. Fig. 1.

Oreopanax chinense Dunn, Jour. Linn. Soc. Bot. **35:** 500. 1903, op. cit. **39:** 471. 1911; Chung, Mem. Sci. Soc. China **1:** 186. 1924.

A tree, about 10 m. tall, with 6-foliolate leaves, ovate-oblong leaflets, and a terminal panicle formed of pedunculate globose heads of short pedicellate fruits.

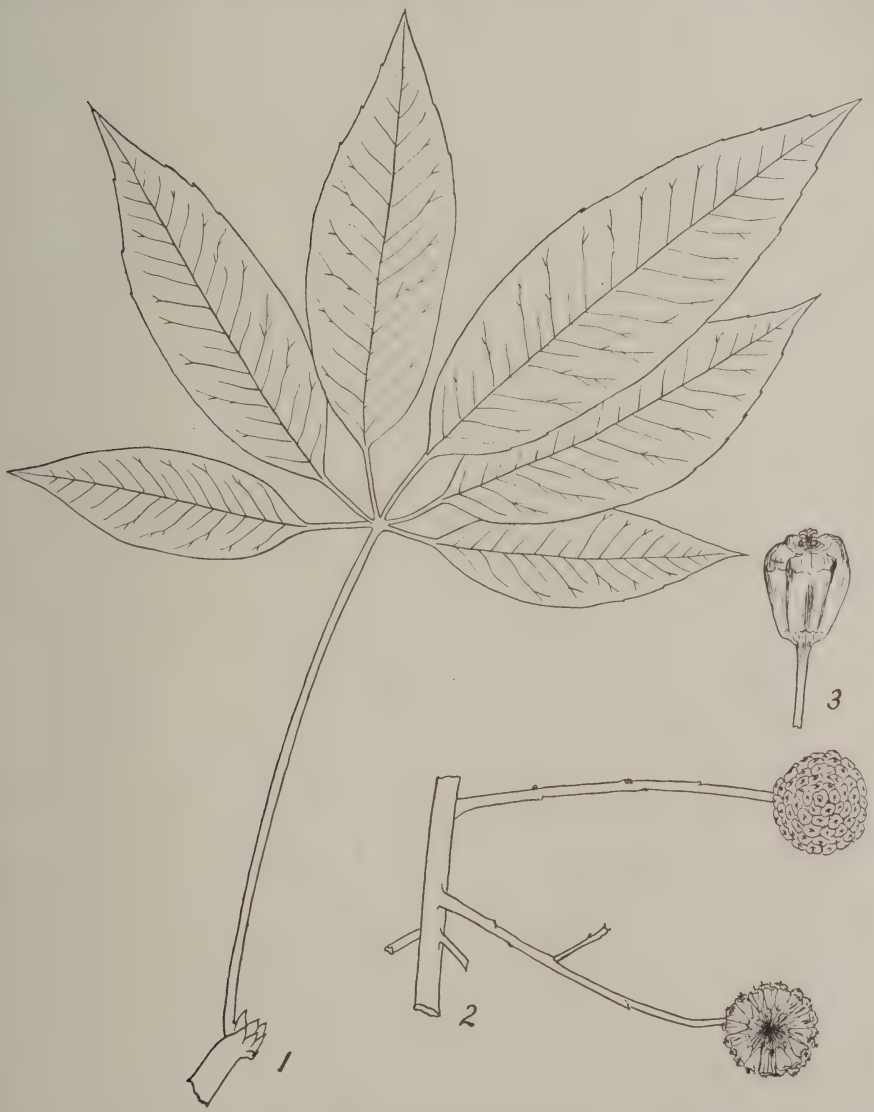

Fig. 1. *Schefflera chinensis; 1.* leaf, × ½; *2.* portion of infructescence, × ½; *3.* fruit, × 3.

Leaves petiolate; petioles slender, glabrous, terete, about 10–17 cm. long; leaflets subcoriaceous, petiolulate, glabrous above, sparsely stellate-tomentose beneath, ovate-oblong, 10–15 cm. or more long, 3.5–5 cm. or more wide, generally broadest below the middle, the apex acuminate, the base broad-cuneate to almost rounded, the margins entire or sparingly serrulate, slightly revolute, the lateral nerves 10–12 on each side, slightly oblique, prominent beneath, the tertiary veins obscure on both surfaces; petiolules glabrous, 0.5–3 cm. long. Inflorescence in a terminal panicle, 30 cm. long, densely tomentose, the lateral branches to 15 cm. long, the flowers subsessile or short-pedicellate, attached to the tip of the peduncle among a group of small hairy bracteoles, in compact globose heads, the heads 1.4 cm. across, terminal or few racemosely arranged on the branches, the peduncles 2 cm. or more long, spreading, the bracts caducous. Calyx densely tomentose, the margin subentire. Petals 5, densely tomentose outside, glabrous inside. Stamens 5. Ovary 5-celled, the styles 5, erect, connate below. Fruit subglobose, angular, 5-celled, sparsely tomentose to glabrous, about 5–6 mm. across, the pedicels 3–5 mm. long, tomentose, the disk small, 2.5 mm. across, the styles 5, united halfway below and radiating and reflexed above, the endosperm ruminate.

YUNNAN: Szemao, *Henry 12939* (ISOTYPE, NY, W); Shang-pa, *H. T. Tsai 59089* (AA).

Dunn describes this as a species of *Oreopanax,* a genus confined mainly to tropical America. This plant, together with *Schefflera Wangii* Li, differs from other Chinese species of *Schefflera* in having globose heads of compactly arranged short-pedicellate fruits. In my judgment, these two species belong to *Schefflera* rather than to *Oreopanax,* in spite of the fact that the endosperm in both cases is ruminate, as noticed by Dunn for *S. chinensis.* Though the endosperm of *Schefflera* is generally considered as uniform, I have found certain other species, such as *S. Bodinieri* (Lévl.) Rehder, having slight ruminations. The endosperm of the two species under discussion is only slightly ruminate.[1] In these characters and in general habit, these two species clearly belong to the genus *Schefflera.*

Schefflera chinensis and *S. Wangii* are related to *S. cephalota* (Clarke) Harms of India and Malacca, but differ from it in the slender petiolules, the presence of bracteoles in the heads, and the smaller disks. Henry mentions having collected only small leaves. The specimens at the herbarium of the New York Botanical Garden, although bearing the same number as those at Kew (photographs by R. C. Ching in NY), are under different labels and may represent distinct collections. Dunn states that the leaflets are entire, but I note that most of them are remotely serrulate, which is also borne out by the photographs of the Kew specimens taken by Ching. *Tsai 59089* is a young flowering specimen with 2 leaflets measuring 30 × 16 cm. The margins are entire and revolute. Description of the flower given above is based on this specimen.

2. **Schefflera Wangii** sp. nov.

Arbor parva, circa 5 m. alta. Foliis 7-foliolatis petiolatis; petiolis gracilibus glabris teretibus circa 15 cm. longis; foliolis coriaceis petiolulatis, supra glabris, subtus sparse stellato-tomentosis vel glabris, inferioribus minoribus ovato-oblongis, 8 × 3.5 cm., medianis majoribus oblongo-ellipticis, 13 × 6 cm., caeteris forma magnitudine intermediis, apice acuminatis, basi attenuatis, pro more ultra medium latioribus, margine integris revolutis, nervis lateralibus utrinsecus 8–10, adscendentibus, subtus prominentibus, venis tertiariis supra obscuris, subtus prominentibus; petiolulis glabris 1–4 cm. longis. Floribus ignotis. Inflorescen-

[1] *Schefflera* differs fundamentally from *Oreopanax* in its flowers being hermaphrodite, with 5–7 styles, while in *Oreopanax* the flowers are polygamo-dioecious or rarely polygamo-monoecious, and the styles in male flowers are one or two only.

tiis fructigeris in racemo axillari subterminali e circa 13 capitulis pedunculatis, compactis, globosis, fructibus plurimis brevipedicellatis, rhachibus circa 18 cm. longis, tomentosis vel glabrescentibus, capitulis 1.5–2 cm. crassis, pedunculis 1.3–5 cm. longis patentibus, bractea triangulari basali 5 mm. longa, 1–4 bracteolis superioribus minoribus fultis. Fructu globoso, obscure pentagono, 5-loculari, sparse tomentoso vel glabro, circa 5 mm. crasso, pedicellis 3–4 mm. longis tomentosis, in apicem pedunculi inter bracteolas parvas pubescentes confluentibus, disco minimo 1–1.5 mm. crasso, stylis 5, in columnam brevem connatis, supra reflexis, albumine leviter ruminato.

YUNNAN: Shun-ming Hsien, *C. W. Wang 71952* (AA); Cheng-kang Hsien, *C. W. Wang 72364* (TYPE, AA), March 1936.

This species is closely related to *S. chinensis* (Dunn) Li, which differs from other Chinese species of the genus in the fruits being arranged in compact heads. It can be distinguished from the latter by its seven leaflets with entire margins, more ascending lateral nerves, and tertiary veins conspicuous beneath; the leaflets are generally broadest above the middle. Moreover, the heads are smaller and with fewer fruits, and arranged in subterminal racemes. In the other species, the heads are arranged in a large terminal panicle with the branches mostly compound. *Wang 71952* is similar to the type except that some of the leaflets have a few deep incisions and are somewhat less pubescent beneath.

3. **Schefflera hypoleucoides** Harms, Rep. Sp. Nov. **16**: 246. 1919; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

A tree 7–15 m. in height, with 7-foliolate leaves, oblong to lanceolate, acuminate leaflets, and large terminal panicles, the flowers in umbels, singly or racemosely arranged on the branches. Leaves long-petiolate, the petioles glabrous to subglabrous, terete, to 30 cm. long; leaflets unequally petiolulate, subcoriaceous, shining above, glabrous or sparsely stellate-pubescent beneath, oblong to lanceolate, the lower ones small, 8 cm. long, 1.3 cm. wide, the median ones larger, 22 cm. long, 8.5 cm. wide, the others intermediate, the apex acuminate, the base attenuate, the margins entire, sometimes lobed or remotely dentate on younger trees, the midrib and nerves distinct above, projecting beneath, the nerves 10–16 on each side, the veins reticulate, distinct above, the petiolules glabrous to subglabrous, the lower ones 0.5 cm. long, the median ones 5 cm. long, the others intermediate. Inflorescence a large terminal panicle, tomentose when young, the primary branches tomentose to subglabrous, 15–30 cm. long, the flowers in umbels singly or racemosely arranged on the branches, the peduncles puberulent to glabrescent, 2–5 cm. long, with a bracteole 5–7 mm. long at the base and one or two 2–3 mm. long in the middle, often bearing abortive buds or occasionally a flower in the axils; umbels many-flowered, 2–2.5 cm. in diameter, the pedicels puberulent, 3–5 mm. long, with small bracteoles at the base. Calyx tomentose, the margin entire to subentire. Petals 5, triangular-ovate, incurved at apex, about 3 mm. long, puberulent, often cohering into a calyptra. Stamens 5, the filaments 5 mm. long. Ovary 5-celled, the disk flat, the styles 5, connate at the base. Fruits (immature) ovoid, subglabrescent, 4 mm. long, the disk 1–1.5 mm. across, the 5 styles connate at the base into a short erect column, their tips radiating and strongly reflexed.

YUNNAN: No precise locality, *Forrest 9790* (NY); Mengtze, *Henry 11435* (AA, NY); Yuanching, *Henry 13301* (AA); Tsing-pian, *H. T. Tsai 52466* (AA); Wen-shan Hsien, *H. T. Tsai 51505* (AA), *51538A* (AA).

A species characterized by the 5 styles connate at the base, with the tips radiating and strongly reflexed, especially in the fruits. It is easily distinguished by this character from *Schefflera hypoleuca* (Kurz) Harms, which it resembles

closely in general appearance. *Forrest 9790* has the leaflets more densely pubescent than the other specimens cited.

4. **Schefflera octophylla** (Lour.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 38. 1894; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1178. *f. 139. no. 5, 6, 7.* 1923; Chung, Mem. Sci. Soc. China **1**: 186. 1924; Merr. Lingnan Sci. Jour. **5**: 139. 1927; McClure, Lingnan Univ. Sci. Bull. **3**: 30. 1931; Merr. Trans. Am. Phil. Soc. II. **24**(2): 291. 1935.

Aralia octophylla Lour. Fl. Cochinch. 187. 1790, ed. Willd. 233. 1793; DC. Prodr. **4**: 258. 1830.

Paratropia cantoniensis Hook. & Arn. Bot. Beechey Voy. 189. 1841; Walp. Rep. **2**: 433. 1843; Benth. Fl. Hongk. 136. 1861.

Agalma octophyllum Seem. Jour. Bot. **2**: 298. 1864, Revis. Heder. 24. 1868.

Heptapleurum octophyllum Benth. ex Hance, Jour. Linn. Soc. Bot. **13**: 105. 1873; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 342. 1888; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 119. 1912.

A tree or shrub, with 6–8-foliolate leaves, the leaflets elliptic, acute or short-acuminate, and with large terminal panicles, the flowers in umbels, racemosely arranged on the lateral branches. Leaves generally 6–8-foliolate, long-petiolate; petioles at first finely pubescent, soon glabrous, 8–25 cm. long; leaflets unequally petiolulate, coriaceous, finely stellate-puberulent on both surfaces, soon glabrous, elliptic or ovate-elliptic, 7–17 cm. long, 3–6 cm. wide, the apex acute or short-acuminate, the base attenuate or nearly rounded, the margins entire, the lateral nerves about 8 on each side, not prominent above, slightly projecting beneath; petiolules glabrous, the lateral ones 1.5–2.5 cm. long, the median ones 3–5 cm. long, the others intermediate. Inflorescence in large terminal panicles, 25 cm. long, the flowers in racemosely arranged umbels on the primary branches, the bracts triangular, small, about 2–3 mm. long, the peduncles about 1 cm. long, with a small bracteole at base and one or two near the middle, the umbels many-flowered, 1–2 cm. in diameter, the pedicels 3–5 mm. long, with a small bracteole at the base, the flowers small, white, fragrant. Calyx pubescent, 5–6-dentate. Petals 5, fleshy, 2–3 mm. long. Stamens 5, the filaments slightly longer than the petals. Ovary 5–8-celled, the disk flat, the styles united into a very short but distinct column, the stigmas indistinct. Fruits globose, 3–4 mm. across, the disk at top 2 mm. across, the calyx-margin persistent, the style-column very short, less than 1 mm. long, the stigmas capitate.

Chekiang: Southern Yentang, Nan-Hoo, *H. H. Hu 185* (AA, LU).

Fukien: Amoy, *Henry 22714* (AA), Hinghwa District, *H. H. Chung 1004* (AA); Changchow, White Cloud Hill, *H. H. Chung 1135* (AA); Foochow, Kushan, *H. H. Chung 1289* (AA); Kushan, A Ieng, near Kushan Monastery, *Tang Siu Ging 6831* (AA); Amoy, *H. H. Chung 5275* (LU); Foochow University and vicinity, *Tang Siu Ging 6967* (LU), *13008* (LU); Kushan Monastery, *Tang Siu Ging 13105* (LU); Ing-hok, Huong-guong Nang, *Tang Siu Ging 13270* (LU); In Hok, Fung Huang Se, *L. Chen 68* (LU).

Yunnan: Tamsui, *Henry 1735* (NY); Szemao, *Henry 12801* (AA); Che-li Hsien, *C. W. Wang 8649* (AA); Che-li Hsien, Sheau-meng-yang, *C. W. Wang 79622* (AA); Meng-him, Jenn-yeh Hsien, *C. W. Wang 79954* (AA), *80111* (AA), *80365* (AA), *80751* (AA).

Kwangsi: South of Nanning, Shih Wan Tai Shan, *R. C. Ching 8234* (AA, W); Wuchow, Tang Uk Shan, *Tang Siu Pan & Fung Hom 27 = LU19147* (LU, NY); Yung Hsien, Ta Tze Tseun, *Steward & Cheo 1086* (AA); Wuchow, *C. C. Wang 308* (LU); Chien Pien District, *S. P. Ko 55814* (AA).

Kwangtung: Hongkong, *Wight s. n.* (W), *101* (W), *179* (G), *287* (W); Hongkong Bot. Garden, *C. S. Sargent s. n.* (AA); Hongkong, *C. S. Sargent s. n.* (AA), *Otto Kuntze 3573* (NY), *C. Ford s. n.* (NY); Tung Wu Mt., *Levine & Groff CCC117* (AA); Canton, *C. O. Levine CCC262* (AA, G, W), *CCC1684* (AA, G, W); no precise locality, *C. O. Levine CCC3400* (AA, G, W); Tung Lu Ping, *W. Y. Chun 6100* (AA); no precise locality, *W. Y. Chun 5204* (AA); Lantau Island, Taai Ae Shann, *W. T. Tsang LU16588* (AA); Hwang Tso Kong, *Y. Tsiang 166* (AA); Ting Wu Shan, *Y. Tsiang 1555* (AA); Lokchong Hsien, route to Siekun, *Y. Tsiang 1449* (AA); Sunyi, Sick Toun, *C. W. Wang 31907* (AA); Yung-

yun City, *S. K. Lau 627* (AA, NY); Wung-Yeun District, Tsin Wen Shan, Wong Chuck I, *S. K. Lau 2262* (AA); Tung-koon District, Lin Fa Shan, *S. K. Lau 20011* (NY); Kun Dzu, Tse Kung, *C. L. Tso 21478* (NY).

HAINAN: No precise locality, *W. Y. Chun UN5903* (W); Ou Yan, *F. A. McClure 7894* (AA); Taam-chan District, Sha Po Shan, *W. T. Tsang 768* = *LU16267* (AA, NY, W), *808* = *LU16307* (LU, NY, W); Wai-yeung District, Kan Lung Fung, *W. T. Tsang 20057* (AA, NY); Fan Yah, *N. K. Chun & C. L. Tso 44020* (AA, NY); Pak Shik Ling, Ku Tung Village, Ching Mai Village, *C. I. Lei 221* (AA, NY, W), *357* (AA, NY, W); no precise locality, *F. C. How & N. K. Chun 70103* (AA, NY, W), *C. Wang 34558* (NY), *34608* (NY), *55127* (NY), *H. Y. Liang 63484* (AA, NY), *63683* (NY, W), *64336* (AA, NY); Chang-kiang District, Ue Lung Shan, *S. K. Lau 3216* (AA); Lekwei, *S. K. Lau 28381* (AA).

ADDITIONAL DISTRIBUTION: From Indo-China to Formosa and the Liukiu Archipelago.

The leaves of this species are sometimes very variable. The ovary is generally 5-celled, but variations between 6–8 cells are not infrequent. The styles are united into a very short but distinct column. Occasionally a few flowers are developed on the peduncles under the umbels and the umbels imperfectly formed, illustrating the transition from a racemose arrangement to an umbellate one.

5. **Schefflera Bodinieri** (Lévl.) Rehder, Jour. Arn. Arb. **11**: 166. 1930, **15**: 114. 1934.

Heptapleurum Bodinieri Lévl. Bull. Acad. Géogr. Bot. **24**: 144. 1914; Fl. Kouy-Tchéou 35. 1914.

A shrub, with 7–9-foliolate leaves, the leaflets membranaceous, linear-lanceolate, remotely serrulate, and with small terminal panicles, the flowers in umbels, racemosely arranged on the branches. Branches mealy-puberulent at first, soon glabrescent. Leaves generally 7–9-foliolate, sometimes 5–6-foliolate, long-petiolate; petioles slender, terete, glabrous, 8–15 cm. long; leaflets unequally petiolulate, membranaceous, dark green above, glaucous beneath, sparingly mealy-puberulent at first, soon glabrescent, the lower ones ovate-lanceolate to lanceolate, 4–7 cm. long, 1–1.6 cm. wide, the median ones linear-lanceolate, 10–16 cm. long, 1–2.5 cm. wide, the others intermediate, the apex long-acuminate, the base broadly cuneate to rounded, the margins remotely 1–8-dentate on each side, rarely entire, the midrib prominent above, projecting below, the lateral nerves 8–16 on each side, obsolete; petiolules glabrous, the lateral ones short, 1–2 mm. long, the median ones 1.5–5 cm. long, the others intermediate. Inflorescences in terminal panicles, 7–15 cm. long, mealy-puberulent, the flowers in racemosely arranged umbels on the primary branches, the peduncles about 1–2 cm. long, bibracteolate, the bracteoles short, often inserted below the middle of the peduncle and often with abortive buds in the axils, the umbels many-flowered, about 2 cm. in diameter, the pedicels 2–5 mm. long. Calyx puberulent, 5-dentate. Petals 5, oblong-ovate, 3–3.5 mm. long, acute, reflexed, sparsely mealy without. Stamens 5, the filaments slightly longer than the petals. Ovary 5-celled, the disk annular, thick, the styles connate into a column, 1–2 mm. long, the stigmas indistinct. Fruits red, 5-celled, globose, slightly 5-angular, 5–6 mm. across, the disk at top thick, 2.5 mm. across, the calyx-teeth persistent, the style-column 2–3 mm. long, the stigmas capitate, the endosperm slightly ruminate.

SZECHUAN: Nanchuan Hsien, *W. P. Fang 5740* (AA).

KWEICHOW: Long-ly, *J. Cavalerie 1578* (AA); District of Tsin-gay, valley of Kia-la-tchang, *J. Laborde in herb. Bodinier 2459* (SYNTYPE, merotype in AA); Kiangchow, *Y. Tsiang 7503* (NY); Ta-ho-yen, Fan Ching Shan, *Steward, Chiao, & Cheo 725* (AA, NY), *758* (AA, NY).

KWANGSI: Lin-yuin Hsien, Loh Hoh Tseun, Loa Shan-loa-ling, *Steward & Cheo 11* (AA, NY).

This species is easily distinguished from its allies by its small, narrowly linear-lanceolate, remotely serrulate, membranaceous leaflets, and its small inflorescence. It is to be noted that the endosperm is slightly ruminate.

6. **Schefflera macrophylla** (Dunn) Viguier, Ann. Sci. Nat. IX. Bot. **9**: 330. 1909; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Heptapleurum macrophyllum Dunn, Jour. Linn. Soc. Bot. **35**: 499. 1903; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 297, 331. 1930.

A tree, 5–10 m. tall, with large 7-foliolate leaves, ovate-oblong, short-acuminate leaflets, and large terminal panicles, the flowers in racemosely arranged umbels, on the branches. Leaves very large, generally 7-foliolate, long-petiolate; leaflets long-petiolulate, coriaceous, glabrous above, white-tomentose beneath, ovate-oblong, 20–55 cm. long, 8–25 cm. wide, the apex short-acuminate, the base round to cordate, the margins slightly revolute, entire to obscurely serrate, the midrib projecting on both surfaces, the lateral nerves 8–12 on each side; petiolules glabrous, 5–17 cm. long. Inflorescence a large terminal panicle to 50 cm. long, densely ferruginous-tomentose; flowers in umbels, these racemosely arranged on the primary branches, the branches to 22 cm. long, with large bracts at the base 1.5 cm. long, the peduncles 2 cm. long, with triangular bracteoles at the base 0.5 cm. long, the umbels many-flowered, 1.5 cm. in diameter, the pedicels 2–3 mm. long, the flowers small. Calyx pubescent, 5-dentate. Petals 5, pubescent without, glabrous within, 2 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 5-celled, the disk flat, the styles connate into a column, about 0.5 mm. long.

YUNNAN: Szemao, *Henry 13409* (ISOTYPE, AA, W), *13409A* (NY); no precise locality, *Forrest 27186* (AA); Shang-pa Hsien, *H. T. Tsai 56628* (AA).

A species characterized by its large leaves and the large ferruginous-tomentose inflorescences.

7. **Schefflera impressa** (C. B. Clarke) Harms in Engl. & Prantl, Nat. Pflanzenfam. 3(8): 38. 1894; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Hedera tomentosa Ham. in D. Don, Prodr. Fl. Nepal. 187. 1825; DC. Prodr. **4**: 264. 1830; non *Schefflera tomentosa* (Seem.) Harms.

Panax tomentosum Wall. in DC. Prodr. **4**: 254. 1830.

Agalma tomentosum Seem. Jour. Bot. **2**: 298. 1864, Revis. Heder. 25. 1868.

Heptapleurum impressum C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 728. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 454. 1911; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 119. 1912.

A tree to 20 m. tall, with 7-foliolate leaves, short-petiolulate, lanceolate to oblanceolate leaflets, and large terminal panicles with the flowers in racemosely arranged umbels on the lateral branches. Leaves generally 7-foliolate, sometimes 5-foliolate, long-petiolate, the petioles slender, terete, puberulent to glabrescent, 15–50 cm. long; leaflets equally short-petiolulate, coriaceous, glabrous or rugose above, stellate-pubescent beneath, soon glabrescent to glaucous, lanceolate to oblanceolate, more or less equal, 12–20 cm. long, 3–5 cm. wide, the apex acuminate, the base broadly attenuate, the margins entire, sometime distantly lobed or serrate on young trees, the midrib and nerves projecting beneath, the nerves 8–12 on each side, the veins reticulate and impressed above; petiolules 1–2.5 cm. long, puberulent to glabrescent. Inflorescence in large terminal panicles, 30–40 cm. long, stellate-tomentose, the lower branches to 20 cm. long, the bracts 5 mm. long; flowers in umbels, racemosely arranged on the primary branches; peduncles 2.5–4 cm. long, the bracteoles triangular, 2 mm. long, the umbels many-flowered, 1.5–3 cm. in diameter, the pedicels 6–8 mm. long, with small bracteoles at base. Calyx densely pubescent, 5-dentate. Petals 5, pubescent without, 3 mm. long. Stamens 5, the filaments 4 mm. long. Ovary 5-celled, the disk flat, the styles 5, connate into a column, the stigmas indistinct. Fruit globose, 4–5 mm. across, 5-angled, 5-celled, the disk 2 mm. across, conical, gradually merging into the style-column, 1.5–2 mm. long, the stigmas subcapitate.

YUNNAN: Between Tengyueh and the Burmese border, en route to Sadon, *J. F. Rock 7411* (AA, NY, W); Shweli River drainage basin to summit of Shweli-Salween watershed

east of Tengyueh, *J. F. Rock 7632* (AA, W); Shang-pa Hsien, *H. T. Tsai 54478* (AA); Che-tse-lo, *H. T. Tsai 54121* (AA), *58363* (AA); Taron-Taru divide, Valley of Bucahwang, *T. T. Yü 20118* (AA).

ADDITIONAL DISTRIBUTION: Himalayan region.

The Chinese specimens agree well with the available Indian material except that the leaflets are generally sparsely pubescent to glabrescent and sometimes glaucous beneath. As a group, the Chinese plants may deserve varietal standing to separate them from the Indian ones. More material is needed for this decision.

8. **Schefflera producta** (Dunn) Viguier, Ann. Sci. Nat. IX. Bot. **9**: 351. 1909.

Heptapleurum productum Dunn, Jour. Linn. Soc. Bot. **35**: 499. 1903.

A shrub, 1.5–3 m. high, with 5–11-foliolate leaves, the leaflets ovate-lanceolate, long-acuminate, glabrous, and with a terminal paniculate inflorescence formed by umbels. Leaves 5–11 (generally 7–9)-foliolate, long-petiolate; petioles terete, glabrous, 20 cm. long; leaflets petiolulate, chartaceous, glabrous on both surfaces, ovate-lanceolate, 8–15 cm. long, 3–5 cm. wide, the lower ones slightly smaller than the median ones, the apex long-acuminate, the base broadly acute to rounded, the margins sparsely serrate, revolute, the lateral nerves 6–10 on each side, distinct above, projecting beneath, the tertiary veins slightly impressed above; petiolules 1.5–3.5 cm. long, the median ones slightly longer than the lateral ones. Inflorescence a panicle, white- or ferruginous-tomentose to glabrescent, the flowers in umbels, racemosely arranged; umbels many-flowered, 3 cm. in diameter; peduncles 2–3.5 cm. long, tomentose. Calyx densely tomentose, the margin 5-dentate. Petals 5, 3 mm. long, slightly tomentose outside, glabrous inside. Stamens 5, the filaments 3 mm. long. Ovary 5-celled, the disk flat, the styles connate into a short column, 1.5 mm. long.

YUNNAN: Mengtze, *Henry 9530* (ISOTYPE, NY), *11382* (NY p.p.).
KWEICHOW: Langtse, *Y. Tsiang 9519* (NY).

Tsiang 9519 from Kweichow is identical with Dunn's Yunnan type except for the indumentum on the inflorescence, which is white in the former and ferruginous in the latter. See also notes under *S. hypoleuca* Harms. *S. producta* Viguier is very similar in appearance to some species of *Brassaiopsis*. Some of the ovaries are 3-celled. Apparently this species represents a link between these two closely related genera.

9. **Schefflera elata** (Ham.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 38. 1894; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Hedera elata Ham. in D. Don, Prodr. Fl. Nepal. 187. 1825; DC. Prodr. **4**: 264. 1830.

Agalma elatum Seem. Jour. Bot. **2**: 298. 1864, Revis. Heder. 25. 1868.

Heptapleurum elatum C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 728. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 454. 1911.

A tree 10–13 m. tall, with generally 5–7-foliolate leaves, the leaflets elliptic-oblong, glabrous, entire, long-petiolate, and with a terminal paniculate inflorescence formed by umbels. Petioles terete, glabrous, about 15 cm. long; leaflets petiolulate, more or less coriaceous, glabrous above, very slightly tomentose to glaucous beneath, elliptic-oblong, 10–18 cm. long, 5–7 cm. wide, the apex acute, the base rounded to acute, the margins entire, the lateral nerves 6–8 on each side, subconspicuous above, slightly projecting beneath, the tertiary nerves inconspicuous on both surfaces; petiolules more or less equal, 2–3.5 cm. long, glabrous. Inflorescence in terminal panicles, 30–40 cm. long, slightly tomentose to glabrescent, the lower branches usually compound, the flowers in racemosely arranged umbels, the umbels about 12–15-flowered, 2 cm. in diameter, the bracts ovate, 5 mm. long, the peduncles 1.5–2 cm. long, slightly tomentose, the pedicels 5–7 mm. long, slightly tomentose. Calyx nearly glabrous, the margin slightly 5-dentate. Petals 5, 2 mm. long, glabrous on both surfaces. Stamens 5, the filaments about

2 mm. long. Ovary 5-celled, the disk flat, the styles connate into a short column. Fruit globose, 4–5 mm. across, the style-column very short, about 1 mm. long.

YUNNAN: No precise locality, *Henry 13474* (NY); Kiukiang Valley, Taron, *T. T. Yü 19477* (AA).

ADDITIONAL DISTRIBUTION: India.

This species is very near to *S. hypoleuca* Harms, from which it may be distinguished by the smaller and narrower leaflets which are glabrous beneath, as well as by the nearly glabrous calyx and the glabrous petals.

10. **Schefflera minutistellata** Merrill in herb. sp. nov.

Frutex 1–13 m. altus. Foliis 7–17-foliolatis longe petiolatis; petiolis gracilibus teretibus glabris 15–40 cm. longis; foliolis petiolatis coriaceis, supra glabris, subtus minute stellato-tomentosis, oblongo-lanceolatis, 10–18 cm. longis, 2.5–6.5 cm. latis, inferioribus minoribus, medianis majoribus, apice acuminatis, basi rotundatis vel acutis, marginibus integris, nervis lateralibus utrinsecus 8–12, venis tertiariis inconspicuis, supra vix impressis; petiolulis 1.5–9 cm. longis, exterioribus brevioribus, medianis longioribus. Inflorescentiis terminalibus paniculatis, 30–40 cm. longis, ramulis inferioribus plus minusve compositis, floribus umbellatis, umbellis in ramis ultimis racemose dispositis, pedunculis 2–3.5 cm. longis, umbellis plurifloris 2 cm. latis; pedicellis 6 mm. longis pubescentibus, bracteis minimis ad basim fultis. Calyce stellato-pubescente 5-dentato. Petalis 5 utrinque glabris 2–3 mm. longis. Staminibus 5, filamentis 3–4 mm. longis. Ovario 5-loculari, disco plano, stylis in columnam brevem connatis, stigmatibus obscuris. Fructu globoso vel ovoideo, 3 mm. longo, 4 mm. crasso, disco crasso et lato, stylo 2 mm. longo, stigmatibus capitatis.

YUNNAN: Between Tengyueh and the Burmese border, en route to Sadon, *J. F. Rock 7278* (AA, NY, W); Chiu-pei Hsien, *H. T. Tsai 51443* (AA); Mienning, Poshan, *T. T. Yü 17960* (AA).

KWEICHOW: Chenfeng, *Y. Tsiang 4286* (NY); Tuhshan, *Y. Tsiang 6957* (NY).

KWANGTUNG: Lokchong, O-Hang, *S. P. Ko 51164* (TYPE, AA), Jan. 21, 1931; Foh-chang District, Chong Uen Shan near Kan Fung, *W. T. Tsang 20740* (AA, NY).

KWANGSI: Yeo Mar Shan, North of Hin Yen, *R. C. Ching 7123* (LU, NY); Kwei-lin District, Chi-fen Shan, Hsi-chang Village and vicinity, *W. T. Tsang 28503* (AA).

This species can be distinguished from its allies with umbellate flowers by its more or less unequal, oblong-lanceolate leaflets, which are minutely stellate-tomentose beneath.

11. **Schefflera hypoleuca** (Kurz) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 38. 1894.

Heptapleurum hypoleucum Kurz, For. Fl. Brit. Burma **1**: 539. 1877; Dunn, Jour. Linn. Soc. Bot. **39**: 454. 1911.

A small tree about 5–10 m. tall, with generally 7-foliolate leaves, the leaflets oblong or ovate, unevenly petiolulate, generally glaucous beneath, and with a terminal paniculate inflorescence formed by umbels. Leaves long-petiolate; petioles slender, terete, glabrous, about 30 cm. long; leaflets petiolulate, coriaceous, glabrous above, loosely stellate-tomentose or glaucous beneath, ovate or oblong, 12–20 cm. long, 4–10 cm. wide, the lower ones smaller than the median ones, the apex acute, the base rounded, the margins entire to serrate or lobed, the lateral nerves 8–12 on each side, distinct above, projecting beneath, the tertiary nerves subconspicuous above; petiolules 1–8 cm. long, the median ones long, the outer ones short. Inflorescence in terminal large panicles, 30–40 cm. long, the lower branches often compound, stellate-tomentose to glabrescent, the flowers in racemosely arranged umbels, the umbels many-flowered, 3–3.5 cm. in diameter; peduncles 2–5 cm. long, stellate-tomentose, the bracteoles triangular, 2–3 mm. long; pedicels slender, tomentose, 1–1.4 cm. long. Calyx densely stellate-tomentose,

the margin 5-dentate. Petals 5, 2–3 mm. long, slightly stellate-tomentose outside, glabrous inside. Stamens 5, the filaments 3 mm. long. Ovary 5-celled, the disk flat, the styles connate into a short column, the stigmas indistinct.

YUNNAN: Mengtze, *Henry 9564* (NY, W), *11382* (NY, p.p., W), *11840* (W).
ADDITIONAL DISTRIBUTION: India and Burma.

A photograph of *Henry 9564A* in the Kew Herbarium (by R. C. Ching, in NY) is labeled *Heptapleurum hypoleucum* Kurz var. *hypochlorum* Dunn. A sterile specimen bearing the same number in the herbarium of the Arnold Arboretum consists of the leaves of *Brassaiopsis glomerulata* Regel.

12. **Schefflera hainanensis** Merr. & Chun, Sunyatsenia **2**: 295. *t. 67.* 1935.

A subglabrous tree about 10 m. tall, with 16-foliolate leaves, the leaflets long-petiolulate, ovate, acuminate, and with terminal paniculate inflorescence, the flowers racemosely arranged on the branches. Leaves long-petiolate; petioles terete, glabrous, up to 40 cm. long; leaflets long-petiolulate, chartaceous to subcoriaceous, glabrous, olive-green above, glaucous beneath, variable in shape, mostly ovate to oblong-ovate, 8–15 cm. long, 2–8 cm. wide, the apex acuminate, the base broad-cuneate, the margins entire, the lateral nerves 7–10 on each side, distinct on both surfaces, the veins reticulate and prominent especially above; petiolules 2–7 cm. long, slightly furfuraceous when young. Inflorescence in terminal panicles about 30 cm. long, densely pubescent especially when young, the flowers racemosely arranged on the primary branches, the branches to 9 cm. long, the bracts triangular, 0.5–1 cm. long; pedicels 2–3 mm. long. Calyx pubescent, indistinctly 5-dentate. Petals 5, thin, glabrous on both surfaces, 2 mm. long. Stamens 5, the filaments slightly longer than the petals. Ovary 5-celled, the disk flat, the 5 styles connate into a short column, 0.5 mm. long, the stigmas indistinct. Fruit ovoid, 5-angular, 5-celled, glabrous, 3 mm. long, the style-column 1 mm. long, the stigmas capitate.

YUNNAN: Ping-pien Hsien, *H. T. Tsai 62779* (AA) (a juvenile specimen).
HAINAN: Fan Yah, *N. K. Chun & C. L. Tso 4427* (HOLOTYPE, NY, isotype, AA, W).

A species characterized by its long-petiolate, multifoliolate leaves and the prominently acuminate leaflets, which are glabrous on both surfaces and glaucous beneath.

13. **Schefflera Metcalfiana** Merr. in herb. sp. nov. Fig. 2.

Arbuscula vel frutex, 3–5 m. altus, ramulis novellis stellato-pubescentibus. Foliis plurifoliolatis, foliolis 12–15, interdum paucioribus, longe petiolatis; petiolis gracilibus teretibus glabris 12–13 cm. longis; foliolis longe petiolulatis chartaceis glabris, supra nitentibus, subtus glaucescentibus, ovatis vel ovato-ellipticis, 4–10 cm. longis, 2–4.5 cm. latis, apice acuminatis, basi late cuneatis, margine integris vel remote denticulatis, revolutis, costa supra subprominente, subtus prominente, nervis lateralibus utrinsecus 5–7, supra paulo impressis, subtus prominentibus, venis reticulatis supra subimpressis; petiolulis glabris 1–5 cm. longis. Inflorescentiis in paniculis magnis terminalibus, minute stellato-puberulis, ad 45 cm. longis, floribus racemosis compacte secus ramulos laterales dispositis, ramulis 5–6 cm. longis, bracteis triangularibus acutis 3 mm. longis; floribus parvis albis, pedicellis 3–4 mm. longis. Calyce dense pubescente, 5-dentato. Petalis 5 tenuibus utrinque glabris 2 mm. longis. Staminibus 5, filamentis quam petalis sublongioribus vel petala aequantibus. Ovario 5-loculari, disco plano, stylis in columnam brevem connatis 0.5 mm. longis. Fructu ignoto.

KWANGSI: South of Nanning, Shih Wan Tai Shan, *R. C. Ching 8350* (AA, NY, G); Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24465* (TYPE, AA, NY), Oct. 1–16, 1934, *24428* (AA, NY), *24518* (AA).

This species resembles *Schefflera hainanensis* Merr. & Chun in the many and slender petiolulate leaflets and the racemosely arranged flowers. It may be read-

Fig. 2. *Schefflera Metcalfiana; 1.* leaf, × ½; *2.* portion of inflorescence, × ½; *3.* flower, × 3.

ily distinguished from the latter by its shrubby habit, the much smaller size of the leaflets, the shorter petioles, and the impressed veins. It is named in honor of Prof. F. P. Metcalf of Lingnan University, China.

14. **Schefflera diversifoliolata** sp. nov. Fig. 3.

Arbor 7 m. alta. Foliis 7-foliolatis petiolatis; petiolis teretibus glabris 22 cm. vel ultra longis; foliolis petiolulatis chartaceis, supra glabris, subtus minutissime stellato-tomentosis vel glabris, glaucis, oblongo-ellipticis, magnitudine valde variabilis, infimis minimis, 7 × 3 cm., medianis magnis, 17 × 10 cm., ceteris magnitudine intermediis, apice acuminatis, basi rotundatis, margine integris, nervis lateralibus utrinque 8–15, valde obliquis, supra subconspicuis, subtus prominentibus, venis tertiariis supra inconspicuis, subtus subconspicuis, petiolulis valde inaequalibus, infimis 0.5–2 cm. longis, medianis 6–6.5 cm. longis, ceteris longitudine intermediis, glabris. Floribus ignotis. Inflorescentiis paniculatis, fructigeris glabrescentibus, ramulis lateralibus 20 cm. longis, fructibus racemose dispositis, pedicellis 3 mm. longis, bracteolis triangularibus 1–2 mm. longis. Fructu globoso 4 mm. longo 5-sulcato, disco apice 2 mm. lato, stylo 1.5 mm. longo, stigmatibus perspicuis capitatis.

YUNNAN: Tsing-pian, *H. T. Tsai 52450* (TYPE, AA), Dec. 21, 1932.

A species characterized by the very unequal leaflets, minutely stellate-tomentose beneath, with very oblique lateral nerves, and the petiolules very variable in length. It resembles *Schefflera minutistellata* Merr. in general appearance and

in the minute stellate tomentum of the leaves, but may be distinguished from the latter by the diverse leaflets and the variable petiolules, and more especially by its racemosely instead of umbellately arranged flowers.

Fig. 3. *Schefflera diversifoliolata; 1.* leaf, × ⅓; *2.* portion of infructescence, × ⅓; *3.* fruit, × 4; *4.* diagrammatic cross-section of fruit, × 4.

15. **Schefflera Delavayi** (Franch.) Harms, Bot. Jahrb. **29:** 486. 1900; Harms and Rehder in Sargent, Pl. Wils. **2:** 555. 1916; Chung, Mem. Sci. Soc. China **1:** 186. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17:** 109, 172, 180, 357, 382. 1929–30; Metcalf, Jour. Arn. Arb. **12:** 271. 1931; Hand.-Maz. Symb. Sin. **7:** 690. 1933; Rehder, Jour. Arn. Arb. **15:** 113. 1934.

Heptapleurum Delavayi Franch. Jour. de Bot. **10:** 307. 1896, Pl. Sin. Ecl. Prim. 27. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915.

Schefflera megalobotrya Harms ex Diels, Bot. Jahrb. **29:** 486. 1900; Chung, Mem. Sci. Soc. China **1:** 186. 1924.

Heptapleurum Dunnianum Lévl. Rep. Sp. Nov. **11:** 295. 1912, Fl. Kouy-Tchéou 35. 1914.

A tree, 5–8 m. in height, with generally 4–7-foliolate leaves and acuminate ovate-lanceolate leaflets, these densely white-tomentose beneath and subentire to distantly dentate or lobed; flowers sessile, densely arranged on the many lateral tomentose branches of the terminal inflorescence. Petioles terete, tomentose, soon glabrescent, 12–25 cm. long or more; leaflets petiolulate, coriaceous, glabrous and dark green above, densely white-tomentose beneath, unequal, ovate-lanceolate, 12–24 cm. long, 5–12 cm. wide, the apex acuminate, the base obtuse, the margins subentire to distantly and irregularly dentate or lobed, the lateral nerves 7–13 on each side; petiolules 1–9 cm. long, tomentose. Inflorescence terminal, formed by spike-like densely tomentose branches, the axis soon glabrescent, 30–40 cm. long, the branches 10–15 cm. long, crowded on the axis, the bracts short, ovate, acuminate, 5 mm. long; flowers sessile, crowded on the branches, the bracteoles short, triangular. Calyx tomentose, distinctly 5-dentate, the teeth subhyaline, triangular, acute to mucronate. Petals 5, thin, glabrous on both surfaces, 2 mm. long. Stamens 5, the filaments slightly longer than the petals. Ovary 5-celled, the disk flat, the styles united into a single column, the stigmas indistinct. Fruits numerous, globose, glabrescent, 4–5 mm. across, short-pedicellate, the pedicels about 1 mm. long, the disk 3 mm. across, the style-column 2 mm. long, the stigmas capitate.

Western China: No precise locality, *Wilson 3691* (AA).

Hunan: Wukang, Mt. Yun-shan, *Handel-Mazzetti 2542* (AA); Chang-ning Hsien, Yang Shan, *C. S. Fan & Y. Y. Li 286* (AA); Sinning Hsien, Ma-ling-tung, *Fan & Li 681* (AA).

Hupeh: Enshih Hsien, *H. C. Chow 1956* (AA, NY).

Szechuan: Kuan Hsien, *Wilson 4559* (AA); Omei Hsien, Mt. Omei, *W. P. Fang 3241* (AA); Nanchuan Hsien, *W. P. Fang 5713* (AA, NY); Lo-shan Hsien, *F. P. Wang 23645* (AA); Kuan-hsien, *Y. S. Liu 1864* (AA).

Yunnan: No precise locality, *Forrest 9308* (AA), *11775* (AA), *C. Schneider 4054* (G); Mengtze, *Henry 9214* (AA, NY), *9214B* (AA, NY, W); between Tengyueh and Lungling, *J. F. Rock 7096* (AA, NY, W); Shweli River drainage basin to summit of Shweli-Salween watershed east of Tengyueh, *J. F. Rock 7586* (AA); Wan-shan Hsien, *H. T. Tsai 51489* (AA); Shangpa Hsien, *H. T. Tsai 54526* (AA), *54969* (AA); Dzung-duei, Champutong, *C. W. Wang 66826* (AA); Mienning, Montungshan, *T. T. Yü 17809* (AA); Northwestern Likiang, Mu-kwa-ze on the Yangtze, *R. C. Ching 21563* (AA); South of Chungtien, Chiao-tou on the Yangtze, *K. M. Feng 3086* (AA).

Kweichow: Sanhoa, *Y. Tsiang 6455* (NY); Fan Ching Shan, *Steward, Chiao and Cheo 776* (AA, NY, W).

A species characterized by the thick coriaceous leaflets, which are densely tomentose beneath, and the sessile flowers crowded on the racemosely arranged branches of the inflorescence. The leaflets are very variable in size and form, and are not infrequently distinctly lobed and dentate.

15a. **Schefflera Delavayi** var. **ochrascens** Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61**: 120. 1924, Symb. Sin. **7**: 691. 1933; Metcalf, Jour. Arn. Arb. **12**: 271. 1931.

Schefflera discolor Merr. Lingnan Sci. Jour. **7**: 318. 1929.

Differs from the typical form in having brown tomentum.

Kiangsi: Lungnan District, Oo Chi Shan, near Lam Uk Village, *S. K. Lau 4847* (AA, W).

Kwangtung: Cha Uen Shan, Hoh Pa Tsz, *F. A. McClure LU13773* (isotype of *S. discolor* Merr., AA, LU, NY); Bei Shan, *W. Y. Chun 5672* (AA); Lochang Hsien, Hwan-kun, near Jui-feng, *Y. Tsiang 1335* (AA); Lochang Hsien, Chong Uen Shan, near Kau Fung, *W. T. Tsang 20619* (AA), *20699* (NY, W).

Yunnan: North of Yunnanfu near Schin Lung, *C. Schneider 314* (AA); inter vicos Dsaodjidjing et Hwahung ad or. fluminis Dsolin-ho, *Handel-Mazzetti 4994* (isotype, AA), Sept. 8, 1914.

16. **Schefflera Wardii** Marquand & Shaw, Jour. Linn. Soc. Bot. **48**: 186. 1929.

A shrub 2–3 m. tall, with large 3–5-foliolate leaves, the leaflets ovate-oblong, remotely serrate and tomentose beneath, and with a large tomentose panicle, the flowers racemosely arranged on the lateral branches. Leaves long-petiolate; petioles terete, tomentose to glabrescent, 50 cm. long; leaflets coriaceous, glabrous above, densely stellate-tomentose beneath (tomentum light brown), ovate-oblong, 20–35 cm. long, 10–15 cm. wide, the apex broadly acuminate, the base rounded, the margins remotely serrate toward the upper part, the lateral nerves 10–14 on each side, the nerves and tertiary veins impressed above, projecting beneath; petiolules 3–17 cm. long, tomentose to glabrescent. Inflorescence a large panicle, densely white-tomentose, the flowers small, racemosely arranged on the lateral branches, the branches to 18 cm. long, tomentose, the bracts ovate-oblong, acute, 1.3 cm. long; pedicels 3 mm. long, slender, tomentose, the bracteoles triangular, 2 mm. or less long. Calyx densely tomentose, distinctly 5-dentate. Petals 5, densely tomentose without, glabrous within, 1.5–2 mm. long. Stamens 5, the filaments shorter than the petals. Ovary 5-celled, the disk flat, the styles connate into a column. Fruits unknown.

YUNNAN: Salwin-Kiukiang Divide, Muchielung, *T. T. Yü 21034* (AA).
ADDITIONAL DISTRIBUTION: Southeastern Tibet.

A very distinct species, related to *S. Delavayi* (Franch.) Harms in the dense tomentum on the lower surface of the leaves and on the inflorescence, but differing by the serrate leaflets, with the veins impressed above, the pedicellate flowers, and the densely tomentose petals.

17. **Schefflera shweliensis** W. W. Smith, Notes Bot. Gard. Edinb. **10**: 65. 1917, **17**: 173, 283. 1930.

A shrub 3–10 m. tall, with 7–11-foliolate leaves, oblanceolate long-acuminate leaflets, and large terminal panicles, with the flowers racemosely arranged on the branches. Leaves 7–11-foliolate, sometimes fewer, petiolate; petioles terete, glabrous, to 24 cm. long; leaflets very short-petiolulate, coriaceous, glabrous, dark green above, pale beneath, narrowly oblanceolate, to 15 cm. long and 4 cm. wide, the apex long-acuminate, the base narrowly cuneate, the margins entire, the lateral nerves 7–9 on both sides, hardly conspicuous, the tertiary veins obscure; petiolules glabrous, scarcely over 1 cm. long. Inflorescence terminal, about 20–40 cm. long, paniculate at the base, racemose at the apex, white-tomentose at first, soon glabrescent, the bracts triangular, to 5 mm. long; pedicels 5 mm. long, tomentose, the bracteoles small, triangular. Calyx tomentose to glabrescent, 5-dentate, the teeth acute. Petals 5, glabrous on both surfaces, 2 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 5-celled, the disk flat, the styles united into a column, the stigmas capitate. Fruit globose, 5-celled, about 5 mm. across, indistinctly 5-angular, the disk at the top 2 mm. across, the style-column 1.5 mm. long, the stigmas capitate.

YUNNAN: No precise locality, *Forrest 11814* (NY); West of the Mekong, en route from Pingpo to Youngchang and Tengyueh, Salween watershed, *J. F. Rock 7018* (AA, W); Shweli River drainage basin to summit of Shweli-Salween watershed east of Tengyueh, *J. F. Rock 7639* (AA, W); Lung-ling Hsien, *H. T. Tsai 54518* (AA); Chenkang Hsien, *C. W. Wang 72319* (AA); Tengtehwang, *T. T. Yü 20000* (AA); Mien-ning, Poshan, *T. T. Yü 17940* (AA); Taron-Taru Divide, Tehgai, *T. T. Yü 20980* (AA); no precise locality, *M. K. Li 2189* (AA).

A species characterized by its coriaceous, oblanceolate, long-acuminate, very short-petiolulate leaflets.

18. **Schefflera multinervia** sp. nov.

Arbor circa 8 m. alta. Foliis 5-foliolatis petiolatis; petiolis teretibus glabris 8–12 cm. vel ultra longis; foliolis petiolulatis coriaceis glabris, supra nitidis, subtus glaucis, oblongo-lanceolatis, subaequalibus, circa 15–17 cm. longis, 5–5.5

cm. latis, apice acutis, basi late cuneatis, margine integris, nervis lateralibus utrinsecus 16–22 obliquis, utrinque perspicuis, venis tertiariis utrinque obscuris; petiolulis glabris subaequalibus, 1–2 cm. longis. Inflorescentiis magnis confertis paniculatis, paniculis 25 cm. vel ultra longis, ferrugineo-pubescentibus vel glabrescentibus, ramulis inferioribus compositis ad 20 cm. vel ultra longis, bracteis triangularibus minimis 0.5 mm. longis. Calyce sparse puberulo vel glabro, 5-dentato. Petalis 5, in specimine typico nigris, fide collectoris caeruleis, extus parcissime pubescentibus vel pro more glabris, 2 mm. longis. Staminibus 5. Ovario 5-loculari, disco plano, stylis in columnam connatis. Fructu ignoto.

YUNNAN: Che-tse-lo, *H. T. Tsai 58437* (TYPE, AA), Sept. 9, 1934.

A species related to *Schefflera dumicola* W. W. Smith and *S. Hoi* (Dunn) Viguier, from both of which it may be distinguished by the large number of obliquely and compactly arranged lateral veins of the leaflets.

19. **Schefflera dumicola** W. W. Smith, Notes Bot. Gard. Edinb. **12:** 221. 1920, **14:** 328, 368, 370. 1924, **17:** 178. 1930; Hand-Maz. Symb. Sin. **7:** 691. 1933.

Schefflera stenomera Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61:** 119. 1924.

A shrub 4–6 m. tall, with 5–9-foliolate leaves, the leaflets oblong, acuminate, and with paniculate inflorescences, the flowers racemosely arranged on the branches, the lower branches mostly compound. Petioles terete, slender, glabrous, 15–40 cm. long; leaflets chartaceous, glabrous, dark green above, glaucous beneath, narrow-oblong to lanceolate, 15–24 cm. long, 4–5 cm. wide, the apex acuminate, the base cuneate, the margins entire, the lateral nerves 12–20 on each side, not prominent; petiolules 1.5–4.5 cm. long. Inflorescence a panicle about 40 cm. long, the flowers racemosely arranged on the branches, the lower branches mostly compound, the branches stellate-tomentose to glabrescent, the bracts small, triangular, to 5 mm. long, the pedicels 4 mm. long, tomentose. Calyx glabrous to sparsely tomentose, inconspicuously 5-dentate. Petals 5, glabrous on both surfaces, 2 mm. long, reflexed. Stamens 5, the filaments about the same length as the petals. Ovary 5-celled, the disk flat, the styles united into a column, the stigmas slightly capitate. Fruit globose, 4–5 mm. across, the disk 2 mm. across, the style-column 2 mm. long, the stigmas capitate.

SZECHUAN: Molien, *C. Schneider 1417* (AA) (sterile).

SIKANG: No precise locality, *C. W. Wang 66184* (AA).

YUNNAN: No precise locality, *Forrest s. n.* (NY); Chien-chuan-Mekong divide, *Forrest 22328* (AA, W); Lan-ping Hsien, *H. T. Tsai 54075* (AA); Wei-si Hsien, *C. W. Wang 66718* (AA); Salween Valley, Banhanlo, *T. T. Yü 23116* (AA); Northwestern Likiang, Tsze-kou on the Yangtze, *R. C. Ching 21439* (AA); south of Chungtien, Chiao-tou on the Yangtze River bank, *K. M. Feng 3111* (AA).

This species can be distinguished from its allies especially by its narrowly oblong to lanceolate leaflets, which are usually 4–5 times as long as broad. The reduction of *Schefflera stenomera* Hand.-Maz. was made by Handel-Mazzetti.

20. **Schefflera Hoi** (Dunn) Viguier, Ann. Sci. Nat. IX. Bot. **9:** 333. 1909.

Heptapleurum Hoi Dunn, Jour. Linn. Soc. Bot. **35:** 498. 1903.

Schefflera salweenensis W. W. Smith, Notes Bot. Gard. Edinb. **10:** 64. 1917, **14:** 208. 1924, syn. nov.

A small tree, 5–12 m. in height, with 3–7-foliolate leaves, the leaflets oblong to oblanceolate, and with large terminal panicles, the flowers racemosely arranged on the lateral branches, the lower ones sometimes compound. Leaves petiolate; petioles terete, glabrous, 10–30 cm. long; leaflets subcoriaceous, petiolulate, glabrous above, glaucous beneath, oblong to oblanceolate, 5–18 cm. long, 2.5–7 cm. wide, the apex acute to acuminate, the base rounded to cuneate, the margins entire, sometimes revolute, the lateral nerves 8–12 on each side, manifest above, projecting beneath; petiolules glabrous, 1–5 cm. long. Inflorescence a large ter-

minal panicle, 40–50 cm. long, ferruginous-tomentose to glabrescent, the flowers racemosely arranged on the lateral branches, the branches to 15 cm. long, the lower ones sometimes compound, ferruginous-tomentose, the bracts triangular, to 5 mm. long, the pedicels 2–3 mm. long, ferruginous-tomentose, the bracteoles small, pointed, less than 1 mm. long. Calyx sparsely ferruginous-tomentose to white-tomentose, inconspicuously 5-dentate. Petals 5, glabrous on both surfaces, 1.5–2 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 5-celled, the disk flat, the styles connate into a column, the stigmas indistinct. Fruit globose, glabrous, 4–5 mm. across, inconspicuously 5-angular, the disk 2 mm. across, the style-column 1.5 mm. long, the stigmas capitate, distinct.

YUNNAN: South of Red River, *Henry 9723* (ISOTYPE, NY); Mengtze, *Henry 13462* (AA, NY); Mount Kenyichunpo and region of Champutong, Salween-Irrawadi watershed, *J. F. Rock 11632* (AA, W); Shang-pa Hsien, *H. T. Tsai 54378* (AA), *54451* (AA), *54948* (AA), *56550* (AA), *59033* (AA); Ping-pien Hsien, *H. T. Tsai 61693* (AA); We-si Hsien, *H. T. Tsai 59589* (AA); Champutung, Chi-na-tung, *C. W. Wang 66603* (AA); Champutung, Shi-gi-tung, *C. W. Wang 67162* (AA); Kinkiang Valley, East of Monting, *T. T. Yü 20203* (AA); South of Chungtien, Wo-tso on the Yangtze River bank, *K. M. Feng 3279* (AA).

The leaves of this species are not constant in shape, with variations in the base and apex as indicated in the description above. I consider that *S. salweenensis* W. W. Smith is merely a form with oblanceolate leaflets.

20a. **Schefflera Hoi** var. **macrophylla** var. nov.

A typo foliis majoribus recedit.

Differs from the species in the larger size of the leaves. Leaves 5-foliolate; petioles terete, glabrous, 55 cm. long; leaflets oblanceolate, 30 cm. long, 10 cm. wide, the apex short-acuminate, the base attenuate, the margins entire, the lateral nerves 12–20 on each side.

YUNNAN: Der-la, Cham-pu-tung, *C. W. Wang 66751* (TYPE, AA), Oct. 1935.

Fig. 4. *Schefflera glomerulata; 1.* leaf, × ⅓; *2.* portion of inflorescence, × ⅓; *3.* portion of infructescence, × ⅓; *4.* longitudinal section of flower, × 6; *5.* fruit, × 4.

21. **Schefflera glomerulata** sp. nov. Fig. 4.

Arbor parva 6–7 m. alta. Foliis 3–5-foliolatis, petiolatis; foliolis petiolulatis coriaceis glabris, supra nitidis, subtus pallidis, obovato-ellipticis, 8–15 cm. longis, 3–7 cm. latis, apice obtusis vel acutis, basi cuneatis, margine integris revolutis, nervis lateralibus utrinsecus 8, nervis atque venis tertiariis prominentibus, utrinque perspicuis; petiolulis 1.5–5 cm. longis glabris. Inflorescentiis terminalibus paniculatis, 15–20 cm. longis, tomentosis vel glabrescentibus, bracteis caducis, floribus parvis sessilibus ad 5 in glomerulo quove, pedunculis tomentosis fultis 3 mm. longis, bracteolis caducis. Calyce glabro, margine integro vel subintegro. Petalis 5 tenuibus, utrinque glabris, 1.5 mm. longis. Staminibus 5, filamentis petalorum longitudinem aequantibus. Ovario 5-loculari, disco subelevato, stigmatibus 5 sessilibus. Fructu elongato ovoideo, 5 mm. longo, 3 mm. crasso, manifeste pentagono, sessili vel subsessili, pedicellis circa 1 mm. longis fultis, disco conico acutato pentagono, ⅓ longitudinis fructus aequante.

YUNNAN: No precise locality, *H. T. Tsai 60037A* (TYPE, AA); Ping-pien Hsien, *H. T. Tsai 55347* (AA), *60278* (AA), *60342* (AA) (fruit).

KWEICHOW: Do-wan, Chenfeng, *S. W. Teng 90830* (AA).

KWANGSI: Bako Shan, western Poseh, *R. C. Ching 7463* (LU, NY).

This species is characterized by its sessile glomerulate flowers, short peduncles, and the sessile or subsessile, elongated and pointed fruits. It is apparently close to *Schefflera pauciflora* Viguier, an Indo-Chinese species, differing mainly in the longer peduncles in fruit.

22. **Schefflera tenuis** sp. nov.

Frutex ad 3 m. altus. Foliis 3–5-foliolatis brevipetiolatis; petiolis teretibus glabris 3–6.5 cm. longis; foliolis chartaceis glabris, obovato-ellipticis vel ovato-lanceolatis, 6–10 cm. longis, 1.5–3 cm. latis, pro more ultra medium latioribus, apice longe acuminatis, basi cuneatis, margine integris, nervis lateralibus utrinsecus 5, nervis atque venis tertiariis prominentibus utrinque manifestis; petiolulis glabris 0.5–2 cm. longis. Floribus ignotis. Inflorescentiis fructigeris corymboso-paniculatis, ramulis circa 5, 8–10 cm. longis, gracilibus, subtomentosis, bracteis caducis, fructibus in umbella quave 2–5, pedunculis teretibus 1.5–2 cm. longis; pedicellis gracilibus glabris circa 8 mm. longis. Fructu globoso glabro, manifeste glandulari-punctato, exacte pentagono, 4 mm. crasso, disco minimo plus minusve plano, ⅕ vel ⅙ longitudinis fructus aequante.

YUNNAN: Kuikiang Valley, Taron, *T. T. Yü 19475* (TYPE, AA), July 27, 1938.

A species characterized by the delicate and slender corymbose-paniculate inflorescence and the very small almost indistinct disk on the fruit. The leaflets resemble those of *Schefflera kwangsiensis* Merr. but differ in being generally broader above the middle and longer acuminate.

23. **Schefflera yunnanensis** sp. nov.

Schefflera elliptica sensu Hand.-Maz. Symb. Sin. **7**: 691. 1933, *pro parte,* non Harms.

Frutex scandens, 3–10 m. longus, epiphyticus. Foliis 5-foliolatis breviter petiolatis; petiolis teretibus glabris 5–6 cm. longis; foliolis coriaceis, supra glabris, subtus glaucis, obovato-oblongis vel ovatis, 5.5 cm. longis, 2.5–3 cm. latis, apice acuminatis, basi late cuneatis vel rotundatis, margine integris, nervis lateralibus utrinsecus 5–6, nervis atque venis tertiariis utrinque prominentibus; petiolulis glabris inaequalibus, infimis brevissimis, 2–3 cm. longis, medianis 1.5 cm. longis, intermediis. Floribus ignotis. Inflorescentiis corymboso-paniculatis, ramulis 3–4, fructigeris ad 8 cm. longis, sparse tomentosis, fructibus umbellatis 2–7, umbellis racemose secus ramulos dispositis, pedunculis subtomentosis 7 mm. longis; pedicellis parce tomentosis circa 7 mm. longis. Fructu ovoideo pentagono glandulari-punctato, 4 mm. longo, 2.5 mm. magno, disco conico, ⅓ longitudinis fructus aequante, stigmatibus sessilibus.

YUNNAN: No precise locality, *Forrest 14881* (NY); Tsarong, Salwin-Kiukiang Divide, Northwest of Si-chi-to, *Forrest 21624* (TYPE, AA, isotype, W [as 21642]); inter vicos Tji-ontson et Pipito ad fluvium Lu-djang (Salween) infra Tschemutong, *Handel-Mazzetti 9833* (AA).

A species very near *Schefflera tenuis* Li and *S. kwangsiensis* Merr., differing from the former in the stouter and shorter peduncles and pedicels, the less acuminate leaflets, and the larger disk of the fruit, and from the latter in its epiphytic habit, obovate leaflets, short petioles, unequal petiolules, and smaller fruits.

24. **Schefflera arboricola** Hayata, Ic. Pl. Formos. **6**: 23, *in syn.* 1916; Merr. Lingnan Sci. Jour. **5**: 139. 1927.

Heptapleurum arboricolum Hayata, Ic. Pl. Formos. **6**: 23. *t. 4.* 1916.

A shrub, sometimes scandent, about 3–4 m. tall, with 7–9-foliolate leaves, the leaflets glabrous, ovate-oblong, obtuse to acute, sometimes emarginate, the flowers in umbels, racemosely arranged on the lateral branches of a terminal panicle. Leaves petiolate; petioles slender, terete, glabrous, 12–15 cm. long; leaflets petiolulate, coriaceous, glabrous, shining above, pale green beneath, obovate-oblong, about 9 cm. long and 4 cm. wide, the apex obtuse to acute, sometimes emarginate, the base obtuse, the margins entire, the lateral nerves 5 or 6 on each side, the nerves and tertiary veins more or less projecting and distinct on both surfaces; petiolules glabrous, 2–4 cm. long. Inflorescence a terminal panicle, slightly tomentose to glabrescent, about 20 cm. long, the flowers in umbels, these racemosely arranged on the lateral branches; bracts present in bud, large, ovate, to 1.5 cm. long, densely tomentose, soon caducous; peduncles short, 5 mm. long, with caducous bracteoles; umbels 5–10-flowered, 0.7–1 cm. in diameter, the pedicels 5–8 mm. long. Calyx glabrous, the margin entire to obscurely dentate. Petals 5, glabrous on both surfaces, 2.5 mm. long. Stamens 5, the filaments about as long as the petals. Ovary 5-celled, the disk slightly elevated, the stigmas 5, sessile. Fruits ovoid, glandular-punctate when young, 5 mm. long, 4 mm. wide, distinctly 5-angular, the disk conical, about the length of the fruit.

HAINAN: Near Shui-mun, *F. A. McClure 9596A* (AA, NY), *9596B* (NY); Tan-chow District, Mei Yuen Tsuen, *W. T. Tsang 795* = *LU16294* (AA, NY, W); Ngai District, Nan Shan Ling, *S. K. Lau 350* (AA, W); Ching Mai District, Pak Shik Ling, Ku Tung Village, *C. I. Lei 187* (AA, NY); Yaichow, *H. Y. Liang 63057* (NY), *63435* (AA); no precise locality, *C. Wang 34518* (AA, NY, W), *34622* (NY), *55038* (AA, NY); Liamin, *J. L. Gressitt 1182* (AA); Poting, *F. C. How 72765* (AA), *73229* (AA), *73535* (AA).

ADDITIONAL DISTRIBUTION: Formosa.

A species closely related to *Schefflera venulosa* (Wight & Arn.) Harms, from which it can be distinguished by the 7–9-foliolate leaves, the generally obovate-oblong leaflets, the shorter peduncles and longer pedicels, and the smaller disk of the fruits.

25. **Schefflera kwangsiensis** Merrill in herb. sp. nov.

Frutex 2 m. altus. Foliis 5–7-foliolatis petiolatis; petiolis gracilibus teretibus glabris, 6–12 cm. longis; foliolis coriaceis glabris petiolulatis, oblongo-lanceolatis, plus minusve inter se aequalibus, 5–12 cm. longis, 2–4 cm. latis, apice acuminatis, basi cuneatis, margine integris revolutis, venis lateralibus utrinsecus ad 5 adscendentibus, nervis venisque tertiariis manifestis utrinque prominentibus; petiolulis subaequalibus glabris gracilibus 2.5 cm. longis. Inflorescentiis terminalibus parvis paniculatis, circa 12 cm. longis, tomentellis vel glabrescentibus, plus minusve corymbosis, ramulis 2–3 circa 7 cm. longis, bracteis caducis, floribus umbellatis racemose dispositis, pedunculis 1–1.5 cm. longis subtomentosis, bracteolis caducis, umbellis circiter 8-floris 1 cm. latis; pedicellis 5 mm. longis tomentellis. Calyce brevi et lato, glabro vel sparse tomentoso, 1 mm. longo. Petalis 5 utrinque glabris, circa 2 mm. longis. Staminibus 5, filamentis 3.5 mm. longis. Ovario

5-loculari, disco subelevato, stigmatibus 5 sessilibus. Fructibus ovoideis glabris, circa 7 mm. longis et 5 mm. crassis, perspicue pentagonis, disco conico 5-mero, ⅓ longitudinis fructus aequante, stigmatibus sessilibus.

KWANGSI: Sui-luk District, southwest of Nanning, Mountains surrounding Pa Lan Village, *W. T. Tsang 21788* (TYPE, AA), Feb. 21–30, 1933; Shang-sze District, Shih Wan Tai Shan, near Ping Hoh Village, *W. T. Tsang 22088* (AA) (fruit); Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22177* (AA) (fruit).

KWANGTUNG: *McClure Y124* = *LU18592* (NY), cultivated in Lingnan University Garden.

A species allied to *Schefflera venulosa* (Wight & Arn.) Harms and *S. arboricola* Hay. It differs from both in being a lower and more slender shrub with acuminate leaflets. *McClure Y124* is from a cultivated specimen, its origin unknown. It has narrower leaflets, but probably belongs here.

26. **Schefflera fukienensis** Merr. Sunyatsenia **3**: 255. 1937.

A scandent shrub with 3-foliolate leaves, the leaflets elliptic, and with terminal panicles, the flowers in umbels, racemosely arranged on the branches. Leaves long-petiolate; petioles glabrous, terete, 12–14 cm. long; leaflets petiolulate, subcoriaceous, glabrous on both surfaces, elliptic, 7–9 cm. long, 4.5–5.5 cm. wide, the apex short-acute, the base broadly acute to rounded, the margins entire, slightly revolute, the lateral nerves about 5 on each side, the nerves and tertiary veins distinct on both surfaces; petiolules uneven, the lateral ones 10–12 mm. long, the median ones 4 cm. long. Inflorescence in terminal, loose panicles, about 15 cm. long, the branches oblique, the lower ones to 8 cm. long, the flowers in umbels, these racemosely arranged, 6–10-flowered, about 7–8 mm. in diameter, the peduncles 1 cm. long, the pedicels about 2 mm. long. Calyx glabrous, the margin slightly dentate. Petals 5, ovate, acute, glabrous on both surfaces, 1.6 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 5-celled, rarely 6-celled.

FUKIEN: Without precise locality, *H. H. Chung 6157* (HOLOTYPE, NY).

Known from the original collection only. Very near to *S. venulosa* (Wight & Arn.) Harms, which is a species of wide distribution in southwestern China. The leaves of *S. fukienensis* differ from those of the latter in being all 3-foliolate, and with generally shorter and broader leaflets. More material from Fukien and Kwangtung is desirable to define the relationships of these two species.

27. **Schefflera venulosa** (Wight & Arn.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 39. 1894; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Paratropia venulosa Wight & Arn. Prodr. **1**: 377. 1834; Walp. Rep. **2**: 433. 1843; Wight, Ill. Ind. Bot. **2**: *t. 118*. 1850.

Heptapleurum venulosum Seem. Jour. Bot. **3**: 80. 1865, Revis. Heder. 44. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 729. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 454. 1911; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 295. 1930.

Heptapleurum Cavalerieri Lévl. Rep. Sp. Nov. **9**: 326. 1911, Fl. Kouy-Tchéou 35. 1914.

Schefflera elliptica sensu Hand.-Maz. Symb. Sin. **7**: 691. 1933, pro parte; Rehder, Jour. Arn. Arb. **15**: 114. 1934; non Harms.

A shrub, sometimes scandent and occasionally epiphytic, with 5–7-foliolate leaves, the leaflets elliptic and acute, and with large terminal panicles, the flowers in umbels, racemosely arranged on the lateral branches. Leaves 5- rarely 7-foliolate, petiolate; petioles glabrous, terete, 10–12 cm. long; leaflets petiolulate, coriaceous, glabrous on both surfaces, elliptic, 7–15 cm. long, 3–10 cm. wide, the apex obtuse, acute, or more rarely acuminate, the base rounded to attenuate, the margins entire, slightly revolute, the lateral nerves 4 or 5 on each side, the nerves and tertiary veins distinct on both surfaces; petiolules 1.5–6 cm. long, the lateral ones shorter. Inflorescence in terminal loose panicles, slightly tomentose, soon

glabrous, 10–20 cm. long; flowers small, in umbels, these racemosely arranged on the lateral branches, the bracts triangular, 7 mm. long, soon caducous; peduncles 0.7–1.5 cm. long, with bracts at base, soon caducous, the umbels about 10-flowered, 0.7–1 cm. in diameter, the pedicels 2–3 mm. long. Calyx glabrous, the margin entire to subentire. Petals 5, thin, glabrous on both surfaces, 2 mm. long. Stamens 5, the filaments slightly longer than the petals. Ovary 5-celled, the disk slightly raised, the stigmas 5, sessile. Fruit ovoid, 3–4 mm. long, 5-angular, the disk conical, ¼ the length of the fruit, glandular-punctate when young.

YUNNAN: No precise locality, *Forrest 7698* (NY), *9739* (W), *11558* (W), *11873* (NY); eastern flank of the N'Maikha-Salween divide, *Forrest 17896* (AA); Mengtze, *Henry 9403* (AA, NY), *9403B* (AA, NY, W), *9403D* (AA, W), *10541* (AA, NY, W), *13044* (AA); Mengtze, *Handel-Mazzetti 6047* (AA); Mt. Tien-pi-shan, near Puerfu, *J. F. Rock 2863* (AA, W), *2866* (AA, W); between Tengyueh and Lungling, *J. F. Rock 7232* (AA, W); Shweli River basin, East of Tengyueh, *J. F. Rock 7851* (W); Kien-shuei Hsien, *H. T. Tsai 53121* (AA), *53252* (AA); Lung-ling Hsien, *H. T. Tsai 55034* (AA); Ping-pien Hsien, *H. T. Tsai 60006* (AA); Chen-kan Hsien, *C. W. Wang 72847* (AA); Lang-tsang Hsien, *C. W. Wang 76448* (AA); Fo-hai, *C. W. Wang 73883* (AA), *74308* (AA), *74911* (AA); Nan-chiao, *C. W. Wang 75152* (AA), *76887* (AA); Che-li Hsien, Sheau-meng-yeang, *C. W. Wang 75571* (AA), *75771* (AA); Shunning, Tehseling, *T. T. Yü 16249* (AA); Shunning, Wen-kwan-kuai, *T. T. Yü 16290* (AA); Shunning, Hila, *T. T. Yü 16563* (AA); Huaning, Ta-ko-le, *Y. Tsiang and H. Wang 16290* (AA).

KWEICHOW: Ouest de Lo-fou, rivière de Pia-nai, *J. Cavalerie 2658* (holotype of *Heptapleurum Cavalerieri* Lévl.).

KWANGSI: . Sin Shu, *R. C. Ching 7327* (NY).

ADDITIONAL DISTRIBUTION: India to Indo-China.

Schefflera venulosa (Wight & Arn.) Harms is considered to be a synonym of *S. elliptica* (Bl.) Harms by C. B. Clarke, Handel-Mazzetti, and Rehder, the type of the latter being from Java (*Sciadophyllum ellipticum* Bl. Bijdr. 878. 1826). Craib, in his consideration of the Siamese species of *Schefflera* (Fl. Siam. Enum. **1**: 798. 1931), considers that the two species are distinct, and after comparing our Asiatic and Javan material I am convinced that he is correct. The Chinese material certainly represents the same species as the Indian form originally described by Wight and Arnott and as illustrated by Wight. It differs from the Javan species, *S. elliptica,* in the numerous umbels which are racemosely arranged on the elongated 10–15 cm. long panicle branches, while in Javan material the umbels are few in number and are subcorymbosely arranged on the rather short panicle branches. The typical form of *S. elliptica* (Bl.) Harms is excellently illustrated by Koorders and Valeton, Atlas Baumart. Java **4**: t. *688*. 1916. A glance at Wight's and the Koorders-Valeton excellent illustrations is all that is needed to show the very striking differences between the two species.

28. **Schefflera khasiana** (C. B. Clarke) Viguier, Ann. Sci. Nat. IX. Bot. **9**: 351. 1909; Hand.-Maz. Symb. Sin. **7**: 691. 1933.

Heptapleurum khasianum C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 730. 1879.

A tree with 7-foliolate leaves, the leaflets narrowly oblong, acuminate, and with panicled inflorescence, the flowers in umbels, racemosely arranged on the elongated, tomentose, and compound lateral branches. Leaves generally 7-foliolate, petiolate; petioles terete, glabrous, about 20 cm. long; leaflets coriaceous, glabrous, narrow-oblong, 15–20 cm. long, 6–9 cm. wide, the apex acuminate, the base rounded, the margins entire, the lateral nerves 8–12 on each side, the tertiary nerves distinct beneath; petiolules 2.5–6 cm. long, glabrous. Inflorescence a panicle, 20–30 cm. long, tomentose to glabrescent, the flowers in umbels, these racemosely arranged on the lateral branches, the branches elongated, ascending, compound, tomentose, the bracts oblong, acuminate, 6 mm. long, caducous, the umbels about 8-flowered, the peduncles 8 mm. long, the pedicels 2–3 mm. long,

tomentose to glabrescent. Calyx tomentulose, 5-dentate. Petals 5, tomentulose without, glabrous within. Stamens 5, the filaments slightly longer than the petals. Ovary 5-celled, the stigmas sessile. Fruits globose, 4 mm. across, glabrous, indistinctly 5-angular, the disk depressed-conical, not pentagonal, the stigmas 5, sessile.

YUNNAN: No data, *H. T. Tsai 55894* (AA).
ADDITIONAL DISTRIBUTION: India.

It may be that the oldest name for this species is *Schefflera Wallichiana* (Wight & Arn.) Harms, based on *Paratropia Wallichiana* Wight & Arn. Prodr. **1**: 337. 1834 (*Heptapleurum Wallichianum* Seem.); see Handel-Mazzetti's note (Symb. Sin. **7**: 691. 1933) stating that it is doubtful if the two supposedly different species are distinct.

Doubtful and Excluded Species

1. **Schefflera Fargesii** (Franch.) Harms ex Diels, Bot. Jahrb. **29**: 486. 1900; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Heptapleurum Fargesii Franch. Jour. de Bot. **10**: 306. 1896, Pl. Sin. Ecl. Prim. 26. 1897.

Fragments of the type, fruits, and a very small bit of one leaflet (*Farges 895* & *75*, ex herb. Paris.) are in the herbarium of the Arnold Arboretum. Franchet did not indicate the number of ovary-cells, but an examination of the fruits shows them to be 2-celled, which is definitely not a *Schefflera* character. The plant may well prove to be a species of *Acanthopanax*, but the material available is too fragmentary for more definite determination at this time. In any case it is not a *Schefflera*.

2. **Schefflera pauciflora** Viguier, Ann. Sci. Nat. IX. Bot. **9**: 357. 1909; Hand.-Maz. Oesterr. Bot. Zeitschr. **87**: 124. 1938.

Viguier's species was based on a fruiting specimen collected in Tonkin by Balansa. Handel-Mazzetti has recorded the species as occurring in Kwangsi on the basis of *Ching 8078*. I have seen no Chinese material that I would refer to Viguier's species and suspect that Handel-Mazzetti may have had a specimen representing what I have described as *Schefflera glomerulata* Li.

V. DIPLOPANAX Handel-Mazzetti

Diplopanax Hand.-Maz. Sinensia **3**: 198. 1933.

A glabrous, unarmed tree. Leaves simple, entire, exstipulate. Flowers in single, terminal, spike-like inflorescences, the upper ones solitary, the lower ones umbellate, these sessile or peduncled, the bracts caducous, the pedicels none, the flowers articulate just below the calyx tube. Calyx margin 5-dentate. Petals 5, valvate. Stamens 10, 5 often sterile, the anthers oblong. Ovary 1-celled, 1-ovulate, the style single. Fruit 1-seeded, oval, very hard when dry, the mesocarp very thick. Seed laterally compressed and curved, horseshoe-shaped in cross section; endosperm uniform.

Monotypic and endemic in Kwangsi.

1. **Diplopanax stachyanthus** Hand.-Maz. Sinensia **3**: 198. 1933; Chun, Sunyatsenia **4**: 247. 1940. Fig. 5.

A tree 5–13 m. tall, with simple entire leaves, shining above, and with a single terminal inflorescence with sessile flowers arranged singly above and umbellately on short peduncles below. Branches dark brown, with white oblong lenticels. Leaves petiolate, exstipulate, coriaceous, obovate-lanceolate, 9.5–15.5 cm. long, 3.5–6.5 cm. wide, the apex acute, the base narrowly cuneate, the margins entire, glabrous, dark green and shining above, pale green beneath, sparingly stellate-

hairy along the midrib or glabrous beneath, the lateral nerves about 6–11, distinct on both surfaces, the tertiary veins inconspicuous above; petioles stout, glabrous, 2–6 cm. long. Inflorescence single, terminal, to 27 cm. long, the upper part spike-like with the flowers single and sessile, the lower flowers umbellate, the umbels generally 3–5-flowered, on short peduncles, the peduncles becoming gradually longer toward the base of the inflorescence, 0.2–1.5 cm. long, the main axis and peduncles stout; bracts broadly ovate, caducous, the pedicels absent, the flowers

Fig. 5. *Diplopanax stachyanthus; 1.* branchlet with inflorescence, × ½; *2.* flower in bud, × 4; *3.* the same, longitudinal section, × 4; *4.* fruit, × ½; *5.* cross-section of fruit, × ½.

articulate below the calyx-tube. Calyx-tube elongated, 3–4 mm. long, densely pubescent, narrow below, broad above, the margin 5-dentate, the lobes triangular, acute. Petals 5, valvate, ovate, acuminate, 3 mm. long, fleshy, pubescent outside. Stamens 10, 5 often sterile, the filaments shorter than the petals, the anthers oblong. Ovary 1-celled, the style conical. Fruit ovoid, hard when dry, 4.5 cm. long, 3.5 cm. broad, slightly compressed laterally, glabrous, with subconspicuous linear nerves and very thick mesocarp, 1-seeded, the seed laterally compressed and curved, horseshoe-shaped in cross-section.

KWANGSI: Bin Long, Minshan, North of Luchen, *R. C. Ching 5969* (ISOTYPE, LU, NY); Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22361* (AA, LU); Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24385* (AA, NY) (fruit); Yaoshan, Ping Nan, *C. Wang 39333* (AA), *40165* (AA).

Tsang's specimens cited above are apparently more mature than were those of Handel-Mazzetti, with generally larger leaves, longer petioles, and with very few hairs on the midrib on the lower surface. *Wang 39333* and *40165* have the flowers all sessile on the main axis. Otherwise these specimens closely agree with the original description and with an isotype. The fruit is here described for the first time. It is very large and quite different from all other araliaceous fruits known to me.

VI. Dendropanax Decaisne & Planchon

Dendropanax Decne. & Planch. Rev. Hort. IV. **3**: 107. 1854.

Gilibertia Ruiz & Pav. Prodr. Fl. Peruv. 50. *t. 8.* 1794; non *Gilibertia* J. F. Gmel. 1791.

Textoria Miq. Ann. Mus. Bot. Lugd.-Bat. **1**: 12. 1863.

Unarmed glabrous trees or shrubs, occasionally slightly pubescent. Leaves simple, entire or sometimes palmately 3–5-lobed, often beautifully pellucid-glandular under transmitted light; stipules small, scarcely united within the petioles or absent. Flowers bisexual or polygamous, umbellate, the umbels solitary or several together, simple or racemosely or paniculately arranged; bracts small or wanting; pedicels not articulate under the flower. Calyx-margin entire or 5-dentate. Petals 5, valvate. Stamens 5, the anthers oval or oblong. Ovary 5-celled. Styles distinct or united throughout their whole length or only at base and spreading at tips. Disk fleshy, shortly conical. Fruit globose or ellipsoid, distinctly or obscurely 5-angular; seeds laterally compressed; endosperm uniform.

About 80 species in tropical America and Eastern Asia.

Type species: *Dendropanax pendulus* (Swartz) Decne. & Planch. (*Hedera pendula* Swartz).

The name *Gilibertia* Ruiz & Pav. is invalid because of the earlier *Gilibertia* J. F. Gmel. A. C. Smith has treated the problem of generic nomenclature in Trop. Woods **66**: 1. 1941, and Merrill, who compiled a list of the known Old World species, has also considered it in Brittonia **4**: 129–134. 1941. Nakai (Fl. Sylvat. Koreana **16**: 41. 1927, and Jour. Jap. Bot. **15**: 6–11. 1939) revived the name *Textoria* Miq. for the Asiatic species. The inflorescence character depended upon by him to separate *Textoria* from *Dendropanax* (simple umbels in *Textoria,* compound inflorescences in *Dendropanax*) fails, for some of the Asiatic species have compound inflorescences while some of the American ones have simple umbels. Among the thirteen species and one variety from China enumerated here, eight have simple umbels, while the other six have compound inflorescences or variations from simple umbels to compound inflorescences within the same species.

Merrill, in his list of Asiatic *Dendropanax* (l.c.), states that "an examination of a long series of tropical American and Asiatic species convinced me that there is no valid reason for generically separating the Old World species from those of the New World. In most of the Old World species the umbels are simple, but several species have compound inflorescences; in some of the New World species they are simple, in others the inflorescences are compound. I can find no constant fruit or flower characters by which two genera may be distinguished."

Prof. Merrill has called my attention to the glands present in the leaves of many of the species, which can be seen by transmitted light. This character is important in differentiating the species, but has been overlooked by most authors. Fortunately, type materials of all the Chinese species are available for this study, and this character is accordingly incorporated in the descriptions as given below.

Key to Species and Varieties

A. Leaves glandular-punctate, the glands more or less evident under transmitted light.
B. Styles distinct for ⅓ their length or more, divergent.
C. Leaves firmly chartaceous to coriaceous, the tertiary veins distinct on both surfaces; inflorescences simple or compound; fruit ovoid.
D. Leaves entire ..... 1. *D. Chevalieri.*
DD. Leaves denticulate ..... 1a. *D. Chevalieri* var. *dentigerus.*
CC. Leaves chartaceous to subchartaceous, the tertiary veins obscure; umbels solitary; fruit globose.
D. Styles distinct, divergent ..... 2. *D. stellatus.*
DD. Styles united for ⅔ their length, divergent above ..... 3. *D. confertus.*
BB. Styles united throughout their whole length into a single column, or, if distinct, then at the tip only and erect, not divergent.
C. Styles united throughout their whole length; inflorescences simple or compound.
D. Leaves membranaceous, lanceolate, mostly deeply 2–3-lobed .... 4. *D. angustilobus.*
DD. Leaves firmly chartaceous, oblong to oblong-elliptic, entire .... 5. *D. oligodontus.*
CC. Styles distinct at their tips, united below into a column; inflorescences always simple.
D. Leaves subcoriaceous; fruit oblong-ovoid, ribbed ..... 6. *D. productus.*
DD. Leaves subchartaceous; fruit globose, not ribbed ..... 7. *D. kwangsiensis.*
AA. Leaves not glandular-punctate.
B. Styles 5, distinct, divergent ..... 8. *D. inflatus.*
BB. Styles united throughout their whole length into a single column.
C. Leaves 3-nerved at the base.
D. Leaves elliptic-ovate to oblong, glabrous on both surfaces; inflorescences glabrous, simple, the umbels many-flowered (up to 100) ..... 9. *D. parviflorus.*
DD. Leaves lanceolate, sparingly tomentose beneath; inflorescences tomentose, compound, the umbels few-flowered (about 20) ..... 10. *D. ferrugineus.*
CC. Leaves not 3-nerved at the base.
D. Leaves oblong-elliptic to elliptic-ovate; inflorescences always compound, with 5–7 umbels ..... 11. *D. hainanensis.*
DD. Leaves elliptic, oblong, or lanceolate; inflorescences simple or with 1–3 umbels.
E. Leaves coriaceous, the lateral nerves inconspicuous, 5–10 on each side; umbels 30(or more)-flowered ..... 12. *D. proteus.*
EE. Leaves subchartaceous to subcoriaceous, the lateral nerves subconspicuous, 10–13 on each side; umbels 10–15-flowered ..... 13. *D. acuminatissimus.*

1. **Dendropanax Chevalieri** (Viguier) Merr. Jour. Arn. Arb. **19:** 59. 1938; Merr. & Chun, Sunyatsenia **5:** 152. 1940; Merr. Brittonia **4:** 132. 1941.

Gilibertia Chevalieri Viguier in Lecomte, Fl. Gén. Indo-Chine **2:** 1181. *f. 141.* 1923.

Dendropanax japonicus sensu Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 342. 1888; Dunn & Tutch. Kew Bull. Add. Ser. **10:** 119. 1912; non Seem.

Gilibertia trifida sensu Chung, Mem. Sci. Soc. China **1:** 186. 1924; non Makino.

Gilibertia sinensis Nakai, Jour. Arn. Arb. **5:** 24. 1924, *pro parte;* Rehder, Jour. Arn. Arb. **8:** 180. 1927; Chien, Contr. Biol. Lab. Sci. Soc. China **3:** 68. 1927.

Gilibertia dentigera var. *anodonta* Hand.-Maz. Symb. Sin. **7:** 692. 1933, Oesterr. Bot. Zeitschr. **88:** 305. 1939, syn. nov.

Gilibertia intercedens Hand.-Maz. Symb. Sin. **7:** 691. 1933, Oesterr. Bot. Zeitschr. **88:** 304. 1939; Merr. Brittonia **4:** 132. 1941, *pro parte,* syn. nov.

Textoria sinensis Nakai, Jour. Jap. Bot. **15:** 9. 1939.

A small tree or shrub, 5–7 m. high, the leaves firmly chartaceous to coriaceous, glabrous, glandular, elliptic, mostly entire, sometimes 3–5-lobed, 3-nerved, the umbels terminal, solitary or few together, either fascicled or umbellately arranged on a short rachis. Leaves with numerous reddish-brown translucent glands, petiolate, generally elliptic, 6–15 cm. long, 3–7.5 cm. wide, sometimes much larger, the apex acuminate, the base attenuate to cuneate, lightly 3-nerved, the margins entire, the lateral nerves about 4–6 on each side, the secondary and tertiary veins elevated and distinct on both surfaces; petioles 0.5–5 cm. long. Inflorescence terminal, glabrous, the flowers in umbels, the umbels solitary or

few together either fascicled at the tips of the branchlets or umbellately arranged on a shortly produced rachis and thus forming a compound inflorescence; umbels many-flowered, the bracts ovate, acuminate, caducous, the peduncles glabrous, 2–3 cm. long, the bracteoles short-triangular, the pedicels glabrous, 0.5–1 cm. long. Calyx glabrous, the margin subentire to slightly dentate, the lobes 5, short, mucronulate. Petals 5, triangular, 2 mm. long, glabrous, reflexed. Stamens 5, erect, the filaments 2.5–3 mm. long. Ovary 5-celled, the styles 5, connate at the base, distinct above, at first erect, later divergent. Fruit oblong, to 7–9 mm. long, very slightly 5-angular or not, with many longitudinal ridges, the styles persistent, divergent.

CHEKIANG: Tien Tai Shan, *H. H. Hu 331* (AA, NY); south of Pangyang, Tai-suan, *R. C. Ching 2100* (AA, W).

ANHWEI: Hwangshan, *N. K. Ip UN4781* (AA), *A. N. Steward UN7141* (AA, W), *R. C. Ching 2937* (AA, W); no precise locality, *R. C. Ching 3181* (AA); Wu Yuan, *R. C. Ching 3229* (AA).

KIANGSI: Tzu-chi Hsien, *H. H. Hu 1238* (AA), *1249* (AA); in monte Hwangdschuling inter Dingschon et Ningdu, *Wang-Te-Hui 376* (isoparatype of *Gilibertia intercedens* Hand.-Maz., AA); Ningdu, Lien-hwaschan, *Wang-Te-Hui 465* (AA).

YUNNAN: Shang-pa, *H. T. Tsai 58678* (AA), *58728* (AA); Ping-pien Hsien, *H. T. Tsai 61564* (AA), *61624* (AA); Bar-ru-lah, Salwin-Kiukiang divide, *C. W. Wang 67557* (AA); Shi-gi-tung, Champutong, *C. W. Wang 67562* (AA); Kiukiang Valley, Taron, Sronwang, *T. T. Yü 20169* (AA); Kiukiang Valley, north of Monting, *T. T. Yü 20382* (AA); Salwin-Kiukiang divide, Muchielung, *T. T. Yü 20584* (AA).

KWANGSI: Seh-feng-dar-shan, south of Nanning, *R. C. Ching 8306* (NY); Shang-sze District, Shap Man Taai Shan, *W. T. Tsang 22650* (AA), *24257* (AA); Yao-shan, *C. Wang 39641* (AA), *40162* (AA); Tse-yuen District, *Z. S. Chung 83453* (AA), *83505* (AA), *83518* (AA), *83534* (AA); Kwei-ling District, Chi-fen-shan, Hsi-chang Village, *W. T. Tsang 28480* (AA).

KWANGTUNG: Lofaushan, *Handel-Mazzetti 132* (AA); Canton, *C. O. Levine CCC1376* (AA, G, W), *CCC1433* (AA, G), *CCC1525* (AA, G, W); Lofaushan, *S. P. Ko 50164* (NY), *Merrill 11035* (NY); Perfect Pool Gorge, *Levine and McClure CCC6841* (NY); Lung T'au Shan, *To & Tsang LU12523* (NY); Hongkong, New Territory, Tai Ue Mountain, *Fung Hom 114 = LU19422* (NY); Lo Chang District, Chong Ueng Shan, near Kau Fung, *W. T. Tsang 20965* (AA); Mei District, Yam Na Shan, *W. T. Tsang 21434* (AA, NY); Wung Yuen District, Fan Shiu Shan, Fan Shiu Au, *S. K. Lau 2741* (AA).

HAINAN: Poting, *F. C. How 73623* (AA).

FUKIEN: Kuliang Hills, near Foochow, *J. B. Norton 1363* (G, W); northern Fukien, Shou-ning, *R. C. Ching 2294* (AA, G, W); Buong Kang, Yenping, *H. H. Chung 3428* (AA).

ADDITIONAL DISTRIBUTION: Indo-China.

This species is characterized by its rather thick leaves, with prominent and elevated veins on both surfaces and reddish-brown translucent glands. The fruit is oblong and with longitudinal ribs. The leaves are very variable in size and are sometimes 3–5-lobed. In some cases, the fruit is infested by insects, resulting in abnormally large sizes and irregular shapes.

As I have interpreted the species it includes very many specimens that are strictly *Textoria* as characterized by Miquel and accepted by Nakai, in that the inflorescences are simple umbels. However, a number of specimens that I cannot otherwise distinguish from *Dendropanax Chevalieri* have distinctly compound inflorescences, in that from two to five umbels are borne on a shortly produced rachis. As Nakai interpreted *Textoria* as having simple umbels to take all the Old World species and *Dendropanax* (*Gilibertia*) as having compound inflorescences and limited to tropical America, the following specimens would fall in the latter group as opposed to the bulk of the cited specimens being strictly *Textoria: Tsang 22650, Steward 7141, Levine 1525, Merrill 11035, Wang 39641, 40162, Chung 83505,* and *Tsai 61564.* Incidentally, intermediate

forms occur, many of the simple-umbelled forms having a solitary terminal umbel, while others have several umbels fascicled at the tips of the branches but without a produced rachis.

Nakai's species (Jour. Arn. Arb. **5**: 24. 1924) is evidently the same as Viguier's. His specimens include both denticulate and entire-leaved forms. He apparently overlooked the glands, as he mentioned in his key that it is "epunctata." In his later treatment (Jour. Jap. Bot. **15**: 1–18. 1939) he distinguished this species from *Dendropanax dentigerus* (Harms) Merr. by its leaves being entire. Certainly *D. dentigerus* differs from *D. Chevalieri* in no other respect than the denticulate leaves. Harms' original description applies only to plants with solitary umbels, but, as Handel-Mazzetti has noted (Symb. Sin. **7**: 692. 1933), there are specimens with compound inflorescences that otherwise agree with Harms' species. The inflorescence of *D. Chevalieri* varies from solitary umbels to several umbels on a somewhat produced axis. In both cases, the styles are united slightly below and divergent above. Occasionally, on otherwise entire-margined leaves of some of the specimens, one or few very small teeth may be found. Thus, the separation of a species on the basis of dentation alone is scarcely warranted. In my judgment, *D. dentigerus* ought to be regarded as a variety of *D. Chevalieri*.

The Yunnan specimens, as well as some of the specimens from Kwangtung and Kwangsi, have much less prominent nerves. Craib (Kew Bull. **1931**: 206. 1931, Fl. Siam. Enum. **1**: 796. 1931) described *Gilibertia siamensis* from Siam, differentiating it from *Dendropanax Chevalieri* by this character. However, there are transitions between them and a sharp line of distinction is difficult to draw. The final decision must await a larger series of specimens from certain regions.

1a. **Dendropanax Chevalieri** var. **dentigerus** (Harms) comb. nov.

Gilibertia dentigera Harms ex Diels, Bot. Jarhb. **29**: 487. 1900; Chung, Mem. Sci. Soc. China **1**: 186. 1924; Hand.-Maz. Symb. Sin. **7**: 692. 1933.

Gilibertia sinensis Nakai, Jour. Arn. Arb. **5**: 24. 1924, *pro parte*.

Gilibertia intercedens Hand.-Maz. Symb. Sin. **7**: 691. 1933, Oesterr. Bot. Zeitschr. **88**: 305. 1939; Merr. Brittonia **4**: 132. 1941, *pro parte*.

Textoria dentigera Nakai, Jour. Jap. Bot. **15**: 8. 1939.

Dendropanax dentigerus Merr. Brittonia **4**: 132. 1941.

Leaves remotely and minutely denticulate.

CHEKIANG: Changhua, *F. N. Meyer 1530* (AA).

KIANGSI: In monte Dunghwa-schan inter Schitscheng et Ninghwa, *Wang-Te-Hui 319* (isotype of *Gilibertia intercedens* Hand.-Maz., AA); Kui-chi and Ning-du, *H. H. Hu 1265* (AA); Tsoongjen, *Y. Tsiang 10127* (NY), *10157* (NY); Kiennan District, Sai Hang Cheung, near Tung Lei Village, *S. K. Lau 3949* (AA); Lungnan District, Oochi Shan, near Lam Uk Tung Village, *S. K. Lau 4428* (AA).

HUNAN: Yun-schan, Wukang, *Handel-Mazzetti 672* = *12309* (AA), *839* = *12407* (AA); Chang-ning Hsien, Shih-tse-yuen, *C. S. Fan and Y. Y. Li 341* (AA).

SZECHUAN: Nan-chuan, Mao-p'o-shan, *C. Bock and A. Rosthorn 750* (HOLOTYPE of *Gilibertia dentigera* Harms, photo. and merotype in AA); Mapien Hsien, *F. T. Wang 23615* (AA).

KWEICHOW: Tuyun, *Y. Tsiang 6764* (NY); Fan Chin Shan, Mo Chao Ho, *Chiao and Cheo 807* (AA, NY, W).

KWANGTUNG: Wung Yuen District, Tsung Wan Shan, Wong Chuk I, *S. K. Lau 2415* (AA).

FUKIEN: Yenping, Shih-sin-keng Village, *H. H. Chung 2855* (AA); Kuliang, *H. H. Chung 6608* (AA).

This variety, like the species, includes material having simple solitary umbels (*Fan & Li 341, Tsiang 10127, Handel-Mazzetti 839 = 12407*) and compound inflorescences, in its variable inflorescence characters conforming to the species.

2. **Dendropanax stellatus** sp. nov.

Frutex circa 1 m. altus. Foliis subchartaceis glabris petiolatis ovato-oblongis, 7–18 cm. longis, 2–5 cm. latis, glanduloso-punctatis, glandulis semipellucidis rufo-fulvis, apice acuminatis, basi late acutis vel rotundatis, 3-nerviis, margine integris, nervis lateralibus utrinsecus 6–12, utrinque elevatis conspicuis, adscendentibus, prope margine anastomosantibus, venis tertiariis obscuris; petiolis 0.5–4.5 cm. longis. Floribus ignotis. Inflorescentiis fructigeris umbellatis terminalibus solitariis glabris, umbella circiter 20 fructus gerente, pedunculis 1.5 cm. longis, pedicellis 8 mm. longis. Fructu (immaturo) globoso 5-loculari, 3.5 mm. diametro, stylis 5, 1.5 mm. longis, ad medium connatis, supra divaricatis.

KWANGSI: San Chiang Hsien, Lao Pao K'ou, *A. N. Steward and H. C. Cheo 1054* (TYPE, AA), Sept. 12, 1935.

The leaves resemble those of *Dendropanax oligodontus* Merr. & Chun in texture and shape but differ in their entire margins. The styles are distinct and divergent above, while in *D. oligodontus* they are united throughout their length into a single erect column. The species differs from *D. Chevalieri* (Viguier) Merr. in the leaves being thinner, ovate-oblong in shape, and with ascending and anastomosing lateral nerves and obscure tertiary veins, as well as in the style character.

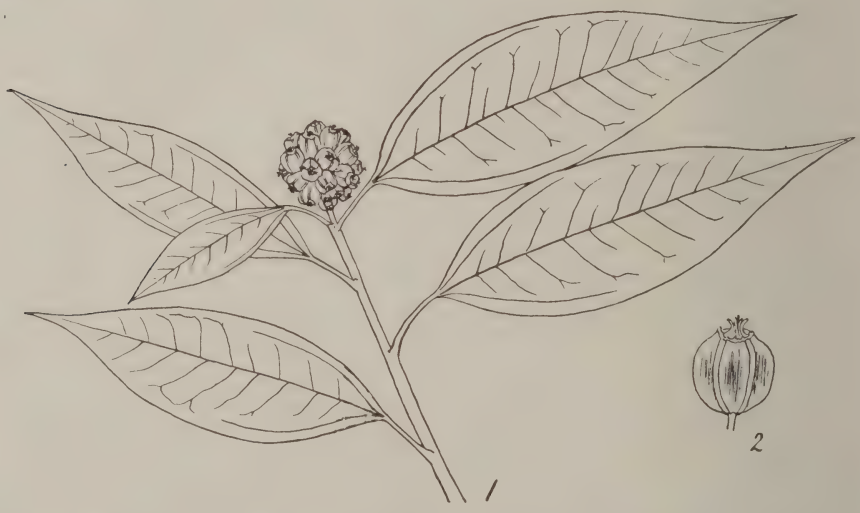

Fig. 6. *Dendropanax confertus;* *1.* branchlet with infructescence, × ½; *2.* fruit, × 2.

3. **Dendropanax confertus** sp. nov. Fig. 6.

Planta arborescens 2–20 m. alta. Foliis chartaceis glabris petiolatis ovato-ellipticis, 6–12 cm. longis, 2–4.5 cm. latis, glanduloso-punctatis, glandulis semipellucidis rufo-fulvis, apice longe acuminatis, basi late cuneatis, 3-nerviis, margine integris vel leviter distanter serrulatis, nervis lateralibus utrinsecus 10–16, utrinque subconspicuis, venis tertiariis obscuris; petiolis 0.5–5 cm. longis. Floribus ignotis. Inflorescentiis fructigeris terminalibus solitariis umbellatis glabris, breviter pedunculatis, umbella valde fructigera, pedunculis 0.5 cm. longis, pedicellis 3–4 mm. longis. Fructibus globosis 6 mm. crassis, angularibus, plus minusve

confertis, stylis 5 brevissimis, 1 mm. vel minus longis, ad medium connatis, apicibus distinctis, divaricatis.

KWANGTUNG: Between Wu Tung and Chang Kiang, *W. Y. Chun 5789* (AA); Lokchang District, Hwan-kun, near Jui Feng, *Y. Tsiang 1331* (AA).

KWANGSI: Yao Shan, *S. S. Sin 11346* (NY), *11742* (NY), *C. Wang 40542* (TYPE, AA), Dec. 4, 1936.

This species is easily recognized by its globose, more or less compactly arranged fruits with very short styles united below and divergent at their tips. It resembles *Dendropanax parviflorus* (Champ.) Benth. in general appearance, but is easily distinguished by its glandular leaves, larger 5-angled fruits, shorter pedicels, fewer-flowered umbels, and divergent styles. It is near *D. Chevalieri* (Viguier) Merr., differing in the leaves with subconspicuous lateral veins and obscure tertiary veins, the shorter pedicels and peduncles, and the globose fruits which are more or less compactly arranged. Moreover, the styles are very short and united to the middle.

4. **Dendropanax angustilobus** (Hu) Merr. Brittonia **4**: 132. 1941.

Gilibertia angustiloba Hu, Jour. Arn. Arb. **11**: 226. 1930; Hu in Hu and Chun, Ic. Pl. Sin. **5**: 36. *t. 236.* 1937.

A shrub, 2 m. tall, the leaves membranaceous, glabrous, narrowly lanceolate, not lobed or more commonly deeply 2- or 3-lobed, glandular, penninerved or slightly 3-nerved at the base, the umbels terminal, 2–3 together umbellately or subracemosely arranged on a short axis. Leaves bright green above, paler beneath, with very minute scattered glands, petiolate, to 20 cm. long, about 2 cm. wide, the apex long-acuminate, the base cuneate to rounded-cuneate, the margins entire or obscurely and very remotely denticulate, the teeth mucronulate, the lobes, when present, narrowly lanceolate, slightly narrowed at the base, tapering toward the apex, the midrib elevated on both surfaces, the lateral nerves about 15–20 or more on each side, scarcely distinguishable, the tertiary veins obscure; petioles 2–11 cm. long, rufous-scurfy at base, finally glabrous. Inflorescence in terminal umbels, 2–3 together, to 12 cm. long, the axis short or almost none, bearing about three umbellately or subracemosely arranged 10–15-flowered umbels, the bracts triangular-lanceolate, acute, 12 mm. long, the peduncles 1–2.5 cm. long, rufous-scurfy, with minute scaly bracteoles at the base. Calyx rufous-scurfy, minutely 5-dentate. Petals 5 or 6, ovate, 4 mm. long, glabrous. Stamens 5 or 6. Ovary 5- or 6-celled, the styles united into a single column, the stigmas punctiform. Fruit globose, 6 mm. in diameter, the style-column persistent, the pedicels slender, to 2 cm. long, scabrid.

KWANGSI: Shih-wan-dar-shan, south of Nanning, *R. C. Ching 8019* (HOLOTYPE, isotype, NY, merotype, AA); Shang-sze District, Shap Man Taai Shan, Tang Lung Village, *W. T. Tsang 24235* (AA).

This species is characterized by its membranaceous, lanceolate, mostly deeply 2- or 3-lobed leaves with obscure veinlets and scattered minute glands. It resembles *Dendropanax proteus* (Champ.) Benth. and *D. acuminatissimus* Merr. in general appearance, but may be readily distinguished by the presence of glands in its much thinner leaves. Hu (in Hu and Chun, Ic. Pl. Sin. **5**: 36. 1937) mentions that "in specimens from three provinces, there is found not a single entire leaf or any departure from the deeply lobed type, a very important diagnostic character for this species." However, *Tsang 24235,* which clearly belongs to this species, has the lower leaves mostly entire and the upper ones 3-lobed.

5. **Dendropanax oligodontus** Merr. & Chun, Sunyatsenia **5**: 151. 1940; Merr. Brittonia **4**: 133. 1941.

A shrub, 1–3 m. tall, the leaves chartaceous, glabrous, oblong to oblong-elliptic, not lobed or deeply 2- or 3-lobed, glandular, 3-nerved, the umbels terminal, soli-

tary or 2–5 together subumbellately arranged on a short rachis. Leaves firmly chartaceous, petiolate, 9–17 cm. long, 3–6 cm. wide, with reddish-brown translucent glands, the apex slenderly acuminate, the base acute to subrounded, 3-nerved, the margins entire below, distinctly and irregularly serrulate or subentire in the upper half, the lateral nerves about 8–10 on each side, slender, ascending, anastomosing, elevated and conspicuous on both surfaces, the tertiary veins obscure; petioles 1–4 cm. long. Inflorescence in terminal umbels, solitary or 2–5 subumbellately arranged on a terminal rachis up to 1 cm. long, the umbels about 2 cm. in diameter, 10–30-flowered, the peduncles 1–1.5 cm. long, the pedicels 4–6 mm. long. Calyx glabrous, 2 mm. long, minutely 5-dentate. Petals 2 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles united into a column about 1 mm. long. Fruit globose, about 5–6 mm. across, 5-seeded or 2–4-seeded by abortion, the style-column persistent, about 2 mm. long.

HAINAN: Po-ting, *F. C. How 73528* (HOLOTYPE, AA), *S. K. Lau 28169* (AA), *28337* (AA).

This species is characterized by its relatively thin, rather many-nerved, and glandular-punctate leaves, which are commonly distantly and irregularly serrulate in the upper part. The leaves of this species are variable in size and shape. The type-specimen has all leaves unlobed, with only one being imperfectly 2-lobed. *Lau 28337* has all leaves unlobed, while *Lau 28169* has only one unlobed leaf and the rest all 3-lobed. These two specimens are fruiting ones with firmer leaves than the type.

Fig. 7. *Dendropanax productus; 1.* branchlet with infructescence, × ½; *2.* fruit, × 4.

6. **Dendropanax productus** sp. nov. Fig. 7.

Frutex circa 1.5 m. altus. Foliis subcoriaceis glabris petiolatis obovato-oblongis, 5–11 cm. longis, 1.5–4 cm. latis, glanduloso-punctatis, glandulis semipellucidis rufo-fulvis, apice longe acuminatis, basi cuneatis, 3-nerviis, margine integris, nervis lateralibus utrinsecus circa 6–10 adscendentibus, supra conspicuis, subtus inconspicuis, venis tertiariis obscuris; petiolis 1–2.5 cm. longis. Floribus ignotis. Inflorescentiis fructigeris umbellatis solitariis terminalibus glabris, umbella circiter 20 fructus gerente; pedunculis 2–2.5 cm. longis, pedicellis 1.2 cm. longis. Fructu oblongo-ovoideo, 7 mm. longo, 3.5 mm. crasso, pentagono, longitudinaliter 5-costato, margine persistente calyce coronato, stylis 1.75 mm. longis, ad ⅘ longitudinis connatis, apicibus distinctis, erectis, seminibus 5.

KWANGTUNG: Hwei-yang District, Lin-fa-shan, Sam Hang Shek T'an Village, *W. T. Tsang 25945* (TYPE, AA), Oct. 1–10, 1935.

This species is near *Dendropanax Chevalieri* (Viguier) Merr., differing in the narrower leaves with inconspicuous lateral nerves above. Moreover, the fruit is long and slender, and the styles erect and united for ⅘ their length.

7. **Dendropanax kwangsiensis** sp. nov.

Frutex circa 2–3 m. altus. Foliis subchartaceis glabris petiolatis ovato-ellipticis, 4.5–12 cm. longis, 1.5–5 cm. latis, glanduloso-punctatis, glandulis semipellucidis flavidis, apice acuminatis, basi acutis 3-nerviis, margine integris, nervis lateralibus utrinsecus 8–10, utrinque subconspicuis, venis tertiariis obscuris; petiolis 0.5–2.5 cm. longis. Floribus ignotis. Inflorescentiis fructigeris terminalibus umbellatis, umbellis solitariis vel 2 vel 3 fasciculatis, glabris, breviter pedunculatis, umbella circiter 20 fructus gerente, pedunculis 0.5–1 cm. longis, pedicellis 1–1.5 cm. longis. Fructu globoso 5–6 mm. diametro, stylis connatis, columna persistente, 1–1.5 mm. longa, apice 2–3-fida, seminibus 5 vel 1–3, caeteris abortivis.

KWANGSI: Shang-sze District, Shap Man Taai Shan, Tang Lung Village, *W. T. Tsang 24270* (AA, NY); Shang-sze District, Shap Man Taai Shan, Nam She Village, *W. T. Tsang 24765* (TYPE, AA, isotype, NY), Nov. 28, 1934.

This species is near *Dendropanax angustilobus* (Hu) Merr., differing in the leaves being slightly thicker, ovate-elliptic in shape, and all unlobed. The fruit resembles that of the latter except that the style-column is divided at the tip.

8. **Dendropanax inflatus** sp. nov.

Arbor circa 10 m. alta. Foliis chartaceis glabris petiolatis eglandulosis ovato-ellipticis, 5.5–13.5 cm. longis, 2.5–5.5 cm. latis, apice acuminatis, basi late acutis 3-nerviis, margine integris, nervis lateralibus utrinsecus circa 4–6, supra inconspicuis, subtus conspicuis, venis tertiariis supra inconspicuis, subtus conspicuis; petiolis 1.5–8 cm. longis. Floribus ignotis. Inflorescentiis fructigeris umbellatis solitariis terminalibus glabris, umbella circiter 15 fructus gerente, pedunculis 3.5 cm. longis, pedicellis 1.75 cm. longis. Fructu 5-loculari oblongo vel pyriformi, 1–1.5 cm. longo, 7 mm. magno, caeruleo (fide collectoris), in specimine typico nigro, leviter angulari, in longitudinem costato, stylis 5 persistentibus 2 mm. longis distinctis divaricatis.

KWANGSI: Ling Wun, *S. K. Lau 28812* (TYPE, AA), July 30, 1937.

The size and shape of the fruit may be due to insect infestation. Although the fact that modifications possibly caused by insect injury are of no diagnostic value, the species is further characterized by being the only one in the group with eglandular leaves that has distinct and divergent styles. The characteristic styles, as well as the oblong ribbed fruit, are similar to those of *Dendropanax Chevalieri* (Viguier) Merr., but the new species is readily distinguished from the latter by its eglandular leaves.

9. **Dendropanax parviflorus** (Champ.) Benth. Fl. Hongk. 137. 1861; Seem. Jour. Bot. **2**: 301. 1864, Revis. Heder. 27. 1868; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 343. 1888; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 119. 1912; Hand.-Maz. Beih. Bot. Centralbl. **52B**: 170. 1934; Merr. Brittonia **4**: 132. 1941.[1]

Hedera parviflora Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Misc. **4**: 122. 1852; Walp. Ann. **5**: 84. 1858.

Gilibertia parviflora Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 41. 1894; Chung, Mem. Sci. Soc. China **1**: 186. 1924.

Textoria parviflora Nakai var. *typica* Nakai, Jour. Jap. Bot. **15**: 7. 1939.

A shrub, about 2–3 m. high, the leaves membranaceous to chartaceous, glabrous, elliptic-ovate or oblong, eglandular, 3-nerved, the umbels terminal, solitary or 2 or 3 together. Leaves petiolate, 5–15 cm. long, 2–5 cm. wide, the apex acuminate,

[1] The Malay Peninsula form referred to the species by C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 733. 1879 is *Dendropanax Maingayi* King.

the base broadly cuneate, slightly or distinctly 3-nerved, the margins entire, the lateral nerves 5–8 on each side, subconspicuous on both surfaces, the tertiary veins obscure; petioles 0.5–8 cm. or more long. Inflorescence in terminal umbels, solitary or 2- or 3-fascicled at the branchlet tips, glabrous, the umbels very many-flowered (about 100 or more), the peduncles 1–1.5 cm. long, thickened at the tip, the pedicels 0.5–1 cm. long. Calyx glabrous, 1.5 mm. long, the margin 5-dentate. Petals 5, 1.5 mm. long. Stamens 5. Ovary 5-celled, the styles united into a column. Fruit globose, about 5 mm. in diameter, the style-column persistent.

KWANGSI: Seh-feng-dar-shan, south of Nanning, *R. C. Ching 7943* (AA, W); Yao-shan, *C. Wang 39974* (AA), *40072* (AA).

KWANGTUNG: Hongkong, *Champion 390* (HOLOTYPE of *Hedera parviflora* Champ., photo. and merotype in AA); Hongkong, *C. Ford s. n.* (NY, W); Tsatmukngao, Lienping, *Handel-Mazzetti 589* in part (AA); Yen-wong-chai, Yao-shan, *S. S. Sin 11020* (NY); Tapu District, Tai Mo Shan, *W. T. Tsang 21224* (AA, NY); Wung-yuen District, Tsing-wan-shan, Wong Chuk I, *S. K. Lau 2012* (AA), *2325* (AA); Sinfung District, Sha Lo Shan, Wa Mei T'ong Village, *Y. W. Taam 283* (AA).

Fig. 8. *Dendropanax ferrugineus; 1.* branchlet with inflorescence, × ½; *2.* flower, × 4; *3.* longitudinal section of flower, × 4; *4.* fruit, × 2.

This species is closely related to *Dendropanax proteus* (Champ.) Benth. in its eglandular leaves, the many-flowered umbels, and the simple style-column. It can be distinguished by its elliptic-ovate to oblong leaves, which are thinner, 3-nerved, and invariably entire rather than lobed.

10. **Dendropanax ferrugineus** sp. nov. Fig. 8.

Frutex parvus circa 1–2 m. altus. Foliis chartaceis vel subchartaceis, supra viridibus glabris, subtus pallide viridibus, parce ferrugineo-tomentosis, mox glabris, eglandulosis, petiolatis, lanceolatis, elobatis vel profunde 2- vel 3-lobatis, ad 25 cm. longis, 1.5–5 cm. latis, apice longe cuspidato-acuminatis, basi acutis vel subrotundatis, leviter 3-nerviis, margine remote serrulatis, lobis lanceolatis, basi paulo angustatis, nervis lateralibus utrinsecus 10–16, inconspicuis vel subconspicuis, venis tertiariis obscuris; petiolis gracilibus 4.5–10 cm. longis. Inflorescentiis terminalibus 4–12 cm. longis, dense ferrugineo-tomentosis, mox glabrescentibus, axibus brevibus vel elongatis, 1–7 cm. longis, umbellas 2–4 circa 20-floras gerentibus, bracteis oblongis 6 mm. longis; pedunculis 2.5–5 cm. longis, bracteolis minimis persistentibus ad basim fultis. Calyce 2.5 cm. longo leviter ferrugineo-tomentoso 5-dentato, lobis triangularibus obtusis. Petalis 5 triangulari-ovatis 2.5 mm. longis glabris. Staminibus 5. Ovario 5-loculari, stylis in columnam connatis. Fructu globoso 8 mm. diametro.

Kweichow: Tating, *Y. Tsiang 8894* (NY).

Kwangsi: Yao Shan, *C. Wang 40174* (type, AA), Oct. 15, 1936.

Kwangtung: Wah-shui-shan, border of Yung-yuen and Ying-tak Districts, *S. K. Lau 957* (AA, NY).

This distinct species is characterized by its lanceolate, remotely serrulate leaves which are eglandular and ferruginous-tomentose with scattered hairs beneath when young. The inflorescence is also densely ferruginous-tomentose when young. The leaves of *Wang 40174* are all entire, those of *Tsiang 8894* all 3-lobed, while those of *Lau 957* are entire as well as 2- and 3-lobed.

11. **Dendropanax hainanensis** (Merr. & Chun) Chun, Sunyatsenia **4**: 247. 1940; Merr. & Chun, Sunyatsenia **5**: 152. 1940; Merr. Brittonia **4**: 132. 1941.

Gilibertia hainanensis Merr. & Chun, Sunyatsenia **2**: 296. *f. 37.* 1935.

Textoria hainanensis Nakai, Jour. Jap. Bot. **15**: 10. 1939.

A tree 10–18 m. high, the leaves chartaceous, glabrous, oblong-elliptic to oblong-ovate, eglandular, the base not 3-nerved, the inflorescence formed by several umbels, umbellately arranged at the tip of the axis and with 1 or 2 racemosely arranged below. Leaves olive to brown, 7–11 cm. long, 2.5–4 cm. wide, the apex slenderly acute to subcaudate-acuminate, the base acute, the margins entire, pinnately nerved, the lateral nerves about 8 on each side, subconspicuous to inconspicuous, the tertiary veins obscure; petioles 1–5 cm. long. Inflorescence terminal, 6–8 cm. long, glabrous, the main axis 4–5 cm. long, with 4–5 umbels umbellately arranged at the tip and usually 1 or 2 racemosely arranged below, the umbels 10–15-flowered, 1.2–1.5 cm. in diameter, the peduncles 2 cm. long, the pedicels 6 mm. long. Calyx 1.5 mm. long, glabrous, the margin subentire, fimbriate. Petals 5, ovate-oblong, 1.5 mm. long, glabrous, reflexed. Stamens 5, the filaments as long as the petals. Ovary 5-celled, the styles united into a single column, the stigmas punctate. Fruit globose, about 1 cm. in diameter, slightly 5-angular.

Kweichow: Kweiting, *Y. Tsiang 5475* (NY); Ta Yo Yen, Fan Chin Shan, *Steward, Chiao, and Cheo 374* (AA, W).

Kwangsi: Chu Fang Shan, Shan Fan, north of Luchen, *R. C. Ching 5918* (NY); Yeo Mar Shan, north of Lin Yen, *R. C. Ching 7213* (NY); Bako Shan, western Poseh, *R. C. Ching 7490* (NY); Shang-sze District, Shap Man Taai Shan, *W. T. Tsang 22406* (AA), *22575* (AA), *22601* (AA); Yao Shan, *C. Wang 39584* (AA), *40070* (AA), *40466* (AA).

Kwangtung: Wan Tong Shan, *H. Y. Liang 60149* (AA).

HAINAN: Fan Yah, *N. K. Chun & C. L. Tso 44103* (HOLOTYPE, NY, isotype, AA); Ng Chi Leng, *N. K. Chun & C. L. Tso 44156* (paratype, NY, isoparatype, AA); Loktung, *S. K. Lau 27343* (AA).

This species is near *Dendropanax Chevalieri* (Viguier) Merr. but is readily distinguishable by its lack of basal marginal nerves and its relatively inconspicuous lateral nerves.

12. **Dendropanax proteus** (Champ.) Benth. Fl. Hongk. 136. 1861; Seem. Jour. Bot. **2:** 301. 1864, Revis. Heder. 27. 1868; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 343. 1888; Dunn & Tutch. Kew Bull. Add. Ser. **10:** 119. 1912; Merr. Brittonia **4:** 134. 1941.

Hedera protea Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Misc. **4:** 122. 1852; Walp. Ann. **5:** 84. 1858.

Gilibertia protea Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 41. 1894; Chung, Mem. Sci. Soc. China **1:** 186. 1924.

Mesopanax proteus Viguier, Ann. Sci. Nat. IX. Bot. **6:** 104. 1906.

Textoria protea Nakai, Jour. Jap. Bot. **15:** 8. 1939.

A shrub 2–3 m. high, the leaves coriaceous, glabrous, broadly elliptic to oblong or lanceolate, entire or deeply 3-lobed, eglandular, the entire leaves penninerved, the bases of the 3-lobed leaves prominently 3-nerved, both types occasionally occurring on the same branchlet, the umbels terminal, solitary or 2 or 3 together. Leaves petiolate, unlobed or sometimes deeply 3-lobed, broadly elliptic to oblong or lanceolate, 2.5–15 cm. long, 1–4 cm. wide, the apex acuminate, the base cuneate, 3-nerved in the 3-lobed leaves, penninerved in the entire leaves, the margins entire, the lateral nerves 5–10 on each side, inconspicuous, the tertiary veins obscure; petioles 0.2–5 cm. long. Inflorescence in terminal umbels, solitary or 2 or 3 together, glabrous, the umbels very many-flowered (30–100), the peduncles 0.5–2 cm. long, dilate at the tip, the pedicels 0.5–1 cm. long. Calyx glabrous, the margin 5-dentate. Petals 5, 2 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles united into a column. Fruit globose, 5 mm. in diameter, the style-column persistent.

KWANGSI: Shang-sze District, Shap Man Taai Shan, Tang Lung Village, *W. T. Tsang 24016* (AA, NY).

KWANGTUNG: Hongkong, *Champion s. n.* (HOLOTYPE of *Hedera protea* Champ., photo. and merotype in AA); Hongkong, *Wight 180* (G, W), *Herb. Hongk. 924* (AA); Hongkong, Happy Valley, *Herb. Hongk. 10198* (AA); Lofaushan, *Merrill 10327* (NY); Hongkong, New Territory, Tai Ue Mountain, *Fung Hom 166 = LU19474* (NY); Mei District, Yam Na Shan, *W. T. Tsang 21316* (AA).

This species is very variable in the shape and size of its leaves and the length of its petioles. It is closely allied to *Dendropanax parviflorus* (Champ.) Benth. and *D. acuminatissimus* Merr., which also have eglandular leaves. It differs from the former in its generally more lanceolate leaves, which are without basal nerves, more coriaceous, frequently lobed, and with less discernible nerves. It can be distinguished from the latter by its much thicker leaves with inconspicuous nerves and its more numerously flowered umbels.

13. **Dendropanax acuminatissimus** Merr. Philip. Jour. Sci. **13:** 152. 1918, Brittonia **4:** 131. 1941.

Gilibertia acuminatissima Hu, Jour. Arn. Arb. **5:** 232. 1924; Chung, Mem. Sci. Soc. China **1:** 186. 1924; Chun, Sunyatsenia **1:** 279. 1934.

Textoria parviflora Nakai var. *acuminatissima* Nakai, Jour. Jap. Bot. **15:** 7. 1939.

A slender erect shrub, 3–4 m. high, the leaves chartaceous to subcoriaceous, glabrous, lanceolate, eglandular, penninerved, the umbels terminal, solitary or in threes. Leaves petiolate, 7–11 cm. long, 1–2 cm. wide, the apex slenderly caudate-acuminate, the base acute, penninerved, the margins entire, the lateral nerves

10–13 on each side, spreading-ascending, anastomosing, subconspicuous to indistinct above, inconspicuous beneath, the tertiary veins obscure; petioles 1–3.5 cm. long. Inflorescence in terminal umbels, solitary or in threes, 10–15-flowered, about 2 cm. across, the peduncles 5–10 mm. long, the bracteoles linear, 2–8 mm. long, caducous, the pedicels about 6 mm. long. Calyx glabrous, about 3 mm. long, the margin minutely 5-dentate. Petals 5, ovate to oblong-ovate, 2.5 mm. long. Stamens 5, the filaments about 2 mm. long. Ovary 5-celled, the styles united into a single column, short, furrowed. Fruit globose, 6 mm. in diameter, the style-column persistent.

KWANGSI: Waitsap District, Tongshan, near Sap-luk Po Village, *W. T. Tsang 22847* (AA).

KWANGTUNG: Canton, *C. O. Levine CCC1315* (AA, G, W); Lofaushan, *Merrill 10187* (HOLOTYPE, NY, isotype, LU); Sinfung District, Sha Lo Shan, Wai Me Tong Village, *Y. W. Taam 123* (AA).

This species is characterized by its very narrowly lanceolate leaves which are not lobed and which lack lateral basal nerves. It is related to *Dendropanax proteus* (Champ.) Benth. and *D. angustilobus* (Hu) Merr., but can be distinguished from the former by its thinner leaves, more distinct and more numerous lateral nerves, and from the latter by the absence of glands in the leaves. Nakai (l.c.) treats this as a variety of *Dendropanax parviflorus* (Champ.) Benth., but I think it is closer to *D. proteus*.

VII. HEDERA Linnaeus

Hedera Linn. Gen. ed. 1. 56. 1737, Sp. Pl. 202. 1753.

Evergreen shrubs, climbing by aerial rootlets. Leaves glabrous, simple, entire or coarsely lobed or dentate; stipules wanting. Flowers in solitary or racemose umbels, the bracts very small; pedicels not articulate under the flower. Calyx-margin subentire or 5-dentate. Petals 5, valvate. Stamens 5, the anthers oval. Ovary 5-celled. Styles connate into a short column. Fruit globose, berry-like, 5-celled, the seeds ovoid; albumen ruminate.

Five species in Europe, North Africa, and Asia.

Type species: *Hedera Helix* Linn.

Hedera Helix Linn. is introduced and planted in different parts of China, especially in the coastal provinces. There are many forms in cultivation, but I have seen only a single sterile Chinese specimen and am unable to determine which variety is represented (Fukien: Koo Long Ue, Yen's Garden, *F. A. McClure B64 = LU19235* [LU, NY]).

1. **Hedera nepalensis** K. Koch var. **sinensis** (Tobl.) Rehder, Jour. Arn. Arb. **4**: 250. 1923, **8**: 180. 1927, **9**: 99. 1928; Chun, Sunyatsenia **1**: 280. 1934.

Hedera Helix sensu Hance, Jour. Bot. **20**: 6. 1882; Franch. Pl. David. **2**: 67. 1888; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 343. 1888; Harms ex Diels, Bot. Jahrb. **29**: 487. 1900; Diels, Notes Bot. Gard. Edinb. **7**: 258, 288. 1912; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 120. 1912; Lévl. Fl. Kouy-Tchéou 34. 1914, Cat. Pl. Yun-Nan 11. 1915; Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933; non Linn.

Hedera himalaica Tobl. var. *sinensis* Tobl. Gatt. Hedera. 79. *f. 39–42.* 1912.

Hedera himalaica sensu Harms & Rehder in Sargent, Pl. Wils. **2**: 555. 1916; Chung, Mem. Sci. Soc. China **1**: 186. 1924; non Tobl.

Hedera sinensis Tobl. Gatt. Hedera. 80. 1912; Chung, Mem. Sci. Soc. China **1**: 186. 1924; Hand.-Maz. Symb. Sin. **7**: 693. 1933.

A scandent shrub, to 20 m. long, with aerial roots. Indumentum on young growth scaly, the scales with 15–20 rays. Leaves simple, petiolate, exstipulate, coriaceous, glabrous, dark green above, pale or yellowish beneath, those of sterile branches triangular-ovate to triangular-oblong, 5–12 cm. long, 3–10 cm. wide,

entire or 3-lobed, usually truncate at the base, those of fertile branches elliptic-ovate to elliptic-lanceolate, 5–12 cm. long, 2–10 cm. wide, the apex acuminate, the base broadly cuneate, the margins entire, the lateral nerves and tertiary veins manifest on both surfaces; petioles scaly, 1–8 cm. long. Inflorescence in umbels, few to many, the peduncles 1–2.5 cm. long, the bracts small, triangular, 2–3 mm. long, the pedicels 0.8–1 cm. long, pubescent. Calyx 2 mm. long, pubescent, the margin subentire. Petals 5, triangular-ovate, 3 mm. long, slightly pubescent outside. Stamens 5, the filaments 2–3 mm. long. Ovary 5-celled, the styles connate into a short conical column. Fruit globose, yellow or red, about 0.8–1 cm. across, the style-column ultimately 1–2 mm. long.

KANSU: Southwestern Kansu, near Siku, *F. N. Meyer 2007* (AA); southern Kansu, Mountains of Motzuping, *J. R. Rock 12063* (AA).

SHENSI: Hou-kio-zaez, *J. Giraldi s. n.* (AA); Tai-pei-shan, *W. Purdom 1011* (AA, W); Hantschung, *Fenzel 976* (AA).

KIANGSU: Shanghai, *D. Macgregor 30* (AA).

CHEKIANG: No precise locality, *Barchet 198* (W), *Chekiang Univ. LU77714* (LU); Ningpo, *D. Macgregor s. n.* (AA); Chu-hsien, Chu-chow, *H. H. Hu 534* (AA, LU, NY); Taichow, *R. C. Ching 1302* (LU, W); Yen Tang Shan, *C. Y. Chiao UN14755* (AA, W); no precise locality, *S. Chen 889* (AA).

ANHWEI: Chu Hwa Shan, *R. C. Ching 2621* (AA, LU).

HUNAN: Hsikwangschan, Hsinhwa, *Handel-Mazzetti 589* in part = *11753* (AA); Yun-schan, Wukang, *Wang-Te-Hui 104* (AA, W); Sinning Hsien, Ma-ling-tung, *S. C. Fan & Y. Y. Li 662* (AA).

HUPEH: No precise locality, *Henry 1258* (W), *2984* (G); Ichang, *Henry 3261* (AA, G), *3341* (G); Hsin Shan, *Wilson s. n.* (NY); Ichang, *Wilson 2437* (AA, G, W); Tien-pong-scian, *Silvestri 1613* (AA); Enshih Hsien, *H. C. Chow 1960* (AA, NY); Chienshih Hsien, *H. C. Chow 1721* (AA, NY).

SZECHUAN: Muli, *Handel-Mazzetti 7540* (AA); between Baor and Tha, *H. Smith 4858* (AA); Muli, Mt. Mitzuga, *J. F. Rock 18270* (AA, NY, W); Tien-chuan Hsien, *W. P. Fang 3436* (AA, NY); Nan-chuan Hsien, *W. P. Fang 5630* (AA, NY, W), *5717* (AA, NY), *5785* (AA, NY); Omei Shan, *W. P. Fang 3140* (AA, NY), *6691* (AA), *T. T. Yü 467* (AA), *531* (AA), *Y. S. Liu 1431* (AA), *C. Y. Chiao & S. C. Fan 310* (AA); Shih-tsien Hsien, *Y. Tsiang 4123* (AA); Ping-shan Hsien, *F. T. Wang 22762* (AA); Kuan Hsien, *S. S. Chien 5702* (AA).

SIKANG: Tachienlu, *A. E. Pratt 789* (G).

YUNNAN: Mengtze, *Henry 9856* (AA, NY), *9856A* (AA, NY); Yuanchuang, *Henry 13304* (AA, W); Shweli-Salwin divide, *Forrest 499* (AA); no precise locality, *Forrest 9245* (AA), *9395* (AA), *11357* (AA); Yunnanfu, *Handel-Mazzetti 173* (W); Yunnanfu bei Pichiquan, *C. Schneider 156* (AA, G); zwischen Yunnanfu und San-ying-pan bei Schin-lung, *C. Schneider 320* (AA); San-ying-pan, Yunnanfu, *C. Schneider 409* (AA); prope pagum Hoji in valle Sung-quah, *C. Schneider 3059* (AA, G, W); inter Hoching et Sung Kweh, *C. Schneider 3267* (AA, G); Kouty, Pei Yen Tsin, *S. Ten 600* (AA, W); District of Likiang, Yangtze watershed, *J. F. Rock 5523* (AA, NY, W); back of Nguluke, western end Likiang plain, *J. F. Rock 5756* (AA, NY, W); Shweli River drainage basin to summit of Shweli-Salwin watershed east of Tengyueh, *J. F. Rock 7626* (AA, NY, W); Yen-shan, *H. T. Tsai 51446* (AA); Lan-pin Hsien, *H. T. Tsai 54085* (AA), *56119* (AA); Wei-si Hsien, *H. T. Tsai 57816* (AA), *57868* (AA), *59594* (AA), *59847* (AA), *59890* (AA), *59919* (AA); Mekong, Tsawarung, *C. W. Wang 66134A* (AA); Dzer-nar, Tsawarung, *C. W. Wang 66351* (AA); Soo-roo-la, Champutong, *C. W. Wang 66655* (AA); Wei-si Hsien, *C. W. Wang 67699* (AA); Li-kiang Hsien, *C. W. Wang 70469* (AA); no precise locality, *T. T. Yü 5264* (AA), *7945* (AA), *10422* (AA); Chungtien Plateau, *T. T. Yü 11322* (AA); Kiukiang Valley, Taron, Muchielu, *T. T. Yü 21006* (AA); Kiukiang Valley, Kungming, *T. T. Yü 20547* (AA); Likiang, Wan-feng-tze, *K. M. Feng 275* (AA); Ru-shu-tong, Hot Spring, near To-kwan-chen, on the banks of the Yangtze River, North of Likiang Snow Range, *K. M. Feng 565* (AA); northwestern Likiang, Tachen on the Yangtze River, *R. C. Ching 21891* (AA); Likiang Valley, *R. C. Ching 30021* (AA).

KWEICHOW: Holupai, Tungtze, *Y. Tsiang 905* (W); Anlung, *Y. Tsiang 7452* (AA, NY, W); Tseh-heng, *Y. Tsiang 9272* (AA, NY); Fan Ching Shan, Ching-chio-ping, Ta Ho Yen, *Steward, Chiao, & Cheo 694* (AA, NY, W).

KWANGTUNG: Maan Chi Shaan, *W. T. Tsang CCC8732* (LU, W); Yam Na Mt., *Chan Kwai Shang 139* = *LU14169* (LU); between Wu-tung and Chiang-kiang, *W. Y. Chun 5782* (AA); Loh-chang District, Chong Uen Shan near Kau Fung, *W. T. Tsang 20652* (AA, NY, W); Wung-kuen District, Fan Shin Shan, *S. K. Lau 2642* (AA); Bird Gorge, Lofaushan, *F. P. Metcalf 17627* (LU); Jen-hwa District, Man Chi Shan, Shek-pik-ha Village, *W. T. Tsang 26148* (AA).

KWANGSI: Yeo Mar Shan, northern Hin Yen, *R. C. Ching 7203* (LU, NY).

FUKIEN: Central Fukien, *Hongk. Herb. 2760* (AA, NY); Kuliang Hills near Foochow, *J. B. Norton 1345* (W); Kuliang and vicinity, *Tang Sui Ging 6765* (AA).

The Chinese plant is very close to the Himalayan species. It chiefly differs in the lobes of the leaves on the sterile branches; these leaves are more or less pinnately lobed with 2–5 lobes on each side in the Himalayan plant and only 3-lobed in the Chinese plant. The leaves are also usually longer and narrower in Himalayan specimens. Material in herbaria has often been variously referred to *Hedera himalaica* Tobl., *Hedera Helix* Linn., *Gilibertia sinensis* Nakai = *Dendropanax Chevalieri* (Viguier) Merr., and *Dendropanax proteus* (Champ.) Benth.

VIII. BRASSAIOPSIS Decaisne & Planchon

Brassaiopsis Decne. & Planch. Rev. Hort. IV. **3**: 106. 1854.

Large shrubs or trees, glabrous or tomentose, armed or not. Leaves palmately lobed, with sinuses of variable depth, or digitately compound; stipules connate within the petiole, not prominent. Flowers often polygamous, in umbels in large compound panicles, stellate-tomentose while young, the bracts small, often persistent; pedicels rising from a dense cluster of persistent bracteoles, not articulate under the flower. Calyx-margin 5-dentate. Petals 5, valvate. Stamens 5, the anthers oval. Ovary 2-celled. Styles 2, united, long or short. Fruit broadly globose or turbinate, 2-seeded or 1-seeded by abortion; seeds not compressed; endosperm uniform or ruminate.

About 20 species distributed from India, Burma, and South China to the Malay Archipelago.

Type species: *Brassaiopsis glomerulata* (Bl.) Regel (*Brassaiopsis speciosa* Decne. & Planch.).

KEY TO SPECIES AND VARIETIES

A. Leaves palmately lobed (Section I. *Palmatae* Harms).
  B. Lobes divided less than half way down the leaf, their bases very broad ...1. *B. Hainla.*
  BB. Lobes divided more than half way down the leaf, their bases more or less narrowed.
    C. Inflorescence prickly.
      D. Leaves coriaceous, the lobes about 10, spinosely serrulate; petiole densely prickly. 2. *B. hispida.*
      DD. Leaves chartaceous, the lobes about 5–7, ciliate-serrate; petiole sparsely prickly. 3. *B. ciliata.*
    CC. Inflorescence unarmed.
      D. Lobes strongly narrowed at the base, with pseudopetiolules.
        E. Pseudopetiolules short, narrowly winged, the lobes very deep, divided to 9/7 the length of the leaf ....4. *B. dumicola.*
        EE. Pseudopetiolules long, widely winged, the lobes divided to 4/5 the length of the leaf ....5. *B. palmipes.*
      DD. Lobes slightly narrowed at the base.
        E. Lobes 3, rarely 4–6 ....6. *B. ficifolia.*
        EE. Lobes 7–9 ....7. *B. fatsioides.*

AA. Leaves digitately compound (Section II. *Digitatae* Harms).
B. Leaflets sessile, 3 or 4 ..... 8. *B. triptcris.*
BB. Leaflets petiolulate, 3–9.
C. Petiolules stout, 1.5–2.5 cm. long; leaves densely ferruginous-bristly. 9. *B. chenkangensis.*
CC. Petiolules slender, 1–4.5 cm. or more long; leaves glabrous to sparsely setose or ferruginous-tomentose.
D. Leaflets membranaceous, sparsely setose above, glabrous beneath, not ferruginous-tomentose ..... 10. *B. gracilis.*
DD. Leaflets membranaceous to chartaceous or coriaceous, glabrous to ferruginous-tomentose, never setose.
E. Leaflets small, 9–18 × 2.5–4.5 cm., narrow, ovate-lanceolate, very long-acuminate. 11. *B. acuminata.*
EE. Leaflets large, 15–25 × 6–10 cm., elliptic-oblong, long- or short-acuminate.
F. Leaflets narrowly cuneate at the base; petiolules 1 cm. long, ferruginous-tomentose to subglabrous ..... 12. *B. shweliensis.*
FF. Leaflets broad-cuneate to rounded at the base; petiolules 2–9 cm. long, glabrous.
G. Inflorescence paniculate.
H. Pedicels of fruits 1.2–1.5 cm. long ..... 13. *B. glomerulata.*
HH. Pedicels of fruits 5–7 mm. long..13a. *B. glomerulata* var. *brevipedicellata.*
G. Inflorescence corymbose-paniculate.
H. Leaflets coriaceous; pedicels of fruits about 1 cm. long. 13b. *B. glomerulata* var. *coriacea.*
HH. Leaflets subchartaceous; pedicels of fruits 2.5 cm. long. 13c. *B. glomerulata* var. *longipedicellata.*

1. **Brassaiopsis Hainla** (Ham.) Seem. Jour. Bot. **2**: 291. 1864, Revis. Heder. 18. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 735. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 425. 1911; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Hand.-Maz. Symb. Sin. **7**: 693. 1933.

Hedera Hainla Ham. in D. Don, Prodr. Fl. Nepal. 187. 1825.

A prickly tree 8–15 m. tall, with chartaceous palmately 5-lobed leaves, the lobes divided to less than half-way down the leaf, and with large terminal panicles formed by umbels, the young parts stellate-tomentose. Leaves 15–25 cm. across, petiolate, stipulate, the base cordate; lobes about 5, divided to ⅔ the length of the leaf, triangular, 8–10 cm. long, 7–9 cm. wide, the apex cuspidate, the base broad, the margins subspinosely serrate, slightly pubescent above, soon glabrescent to glabrous, sparingly stellate-pubescent beneath, the lateral nerves distinct on both surfaces; petioles pubescent at first, soon glabrescent, 15–20 cm. long; stipules not prominent. Inflorescence in large terminal panicles, pubescent at first, the flowers in umbels, these many-flowered, 5 cm. in diameter, the peduncles 4–5 cm. long, the bracts triangular, 5 mm. long, densely stellate-pubescent, persistent, the pedicels 1 cm. long, arising from a dense cluster of bracteoles 2 mm. long and very densely pubescent. Calyx pubescent, 2 mm. long. Petals 5, pubescent outside. Stamens 5, the filaments 3 mm. long. Ovary 2-celled, the disk elevated, the styles united into a column. Fruit globose, subdidymous, about 8 mm. across, the style-column 3 mm. long.

YUNNAN: No precise locality, *Forrest 8192* (AA), *9670* (AA), *12848* (AA, NY, W), *26172* (NY), *26207* (AA, NY); Szemao, *Henry 11882* (AA, W); Yuan-chiang, *Henry 1329* (AA, NY); between Mopo and Man-pieh, *J. F. Rock 2928* (AA, W); Mong-ka, *H. T. Tsai 56305* (AA), *56809* (AA); Lung-ling Hsien, *H. T. Tsai 55510* (AA); Lan-tsang Hsien, *C. W. Wang 76858* (AA); Shunning, Huilungsu, *T. T. Yü 16135* (AA); Salwin Valley, *T. T. Yü 22058* (AA).

ADDITIONAL DISTRIBUTION: India.

A species closely related to *Brassaiopsis palmata* Kurz, from which it may be distinguished by its leaves divided less than halfway down into triangular segments, while in *B. palmata* the leaves are divided into oblong segments. The

several Chinese specimens in herbaria referred to *B. palmata* are *B. Hainla* Seem. Apparently *B. palmata* is not found in China.

2. **Brassaiopsis hispida** Seem. Jour. Bot. **2**: 291. 1864, Revis. Heder. 18. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 736. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 425. 1911; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Hand.-Maz. Symb. Sin. **7**: 694. 1933.

An armed shrub, 1–5 m. tall, with prickly petioles and coriaceous deeply palmately 10-lobed leaves, the lobes spinosely serrate, and with prickly terminal panicles formed by many-flowered umbels. Prickles numerous, lanceolate, compressed, deflexed. Leaves about 30 cm. across, petiolate, stipulate, yellowish when dry; lobes about 10, oblong-lanceolate, divided to $\frac{5}{6}$ the length of the leaf, 20–30 cm. long, 7–9 cm. wide, acuminate at apex, narrowed toward base, the margins spinosely serrate, glabrous above, glabrous or sparingly hispidulous beneath, the lateral nerves and tertiary veins distinct above, very prominent beneath; petioles prickly, 20 cm. long; stipules united within the petioles, the apices free, linear. Inflorescence in terminal panicles, prickly, the flowers in umbels, the umbels many-flowered, 3 cm. in diameter, the peduncles 5 cm. long, prickly, the bracts lanceolate, 1 cm. long, tomentose, persistent, the pedicels ferruginous-tomentose, 1 cm. long, the bracteoles numerous, lanceolate, tomentose. Calyx densely tomentose, 2 mm. long, the margins 5-dentate. Petals 5, 2–3 mm. long, glabrous on both surfaces. Stamens 5, the filaments 2 mm. long. Ovary 2-celled, the disk elevated, hemispherical, the styles united into a column, 1 mm. long.

YUNNAN: Shang-pa Hsien, *H. T. Tsai 54951* (AA); Chiu-kiang, west of Champutung, *C. W. Wang 67568* (AA); Taron-Taru Divide, Ducahwang, *T. T. Yü 20875* (AA).

This species can be distinguished from its allies, *B. fatsioides* Harms and *B. ciliata* Dunn, by its prickly stem, panicles, and petioles, and the spinosely serrate leaves.

3. **Brassaiopsis ciliata** Dunn, Jour. Linn. Soc. Bot. **35**: 499. 1903; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Rehder, Jour. Arn. Arb. **15**: 115. 1934.

Acanthopanax Bodinieri Lévl. Bull. Acad. Géogr. Bot. **24**: 143. 1914, Fl. Kouy-Tchéou 33. 1914.

An armed shrub about 2 m. tall, with sparsely bristle-prickly petioles, chartaceous deeply palmately 5–7-lobed leaves, the margins ciliate-serrate, and with prickly paniculate inflorescence formed by umbels. Leaves about 30 cm. across, petiolulate, the base round-cordate; lobes 5–7, divided to $\frac{3}{4}$ the length of the leaf, oblong, about 15–20 cm. long, 8–12 cm. wide, the apex acuminate, the margins ciliate-serrate, sparsely bristly above and on the nerves beneath, the lateral nerves prominent on both surfaces, the tertiary veins subconspicuous; petioles sparsely bristle-prickly, 20 cm. or more long. Inflorescence in panicles, the main axis and branches prickly, the flowers in umbels, the umbels racemosely arranged. Fruit didymo-globose or ovoid, 7–8 mm. across, 2-seeded, the disk small, 3–4 mm. across, about $\frac{1}{8}$ the length of the fruit, the style-column 2 mm. long, the pedicels slender, 2 cm. long.

SZECHUAN: Mt. Omei, *Y. S. Liu 1726* (AA).

YUNNAN: Feng Chen Lin Peak, *Henry 9180* (AA, NY); Mengtze, *Henry 9180A* (ISOTYPE, W); Wen-shan Hsien, *H. T. Tsai 51890* (AA).

KWEICHOW: Gan-pin, *L. Martin 1924* (holotype of *Acanthopanax Bodinieri* Lévl., photo. in AA); Tuhshan, *Y. Tsiang 6916* (NY).

KWANGSI: Ling-yun Hsien, Loh Hoh Tseun, *Steward & Cheo 402* (AA).

A species allied to *Brassaiopsis fatsioides* Harms, from which it may be easily distinguished by the presence of prickles on the main axis and branches of the inflorescence. The Szechuan specimen cited above is sterile. Its petiole bears scattered strong prickles. A photograph of *Henry 9180* in Kew Herbarium by

R. C. Ching is in the herbarium of New York Botanical Garden, the specimen being labeled *B. hispida* Seem. var. *chinensis* Dunn. It is identical with *Henry 9180* (AA) cited above. The differences between *B. hispida* and *B. ciliata* are given in the discussion of the former.

4. **Brassaiopsis dumicola** W. W. Smith, Notes Bot. Gard. Edinb. **10:** 11. 1917; Chung, Mem. Sci. Soc. China **1:** 187. 1924.

A prickly shrub, 6–9 m. tall, with chartaceous deeply palmately 9-lobed leaves, the leaves subspinose-serrulate, narrowed below forming narrowly winged pseudopetiolules, and with tomentose to glabrescent panicles formed by many-flowered umbels. Leaves 30 cm. or more across, petiolate, stipulate, the base cordate; lobes about 9, divided to $\frac{6}{7}$ the length of the leaf, oblong, 12–18 cm. long, the apex acuminate, the base much narrowed forming narrowly winged pseudopetiolules, the margins subspinose-serrulate, at first white to ferruginous stellate-tomentose on both surfaces, soon glabrescent to glabrous, the lateral nerves prominent beneath; petioles 9–15 cm. long, ferruginous-tomentose; stipules united within the petioles, the apices free, elongate, about 1 cm. long. Inflorescence a panicle to 35 cm. long, tomentose to glabrescent, the main axis stout, the flowers in umbels, the umbels 3 cm. in diameter, many-flowered, the peduncles 3–5 cm. long, stout, the bracts ovate, 1 cm. long, the pedicels 1 cm. long, densely ferruginous-tomentose. Calyx tomentose, 4 mm. long, 5-dentate. Petals 5, 3.5 mm. long, triangular-ovate, tomentose outside. Ovary 2- or 3-celled, the disk elevated, the styles united into a column, 2 mm. long.

YUNNAN: Ma-chang-kai Valley, north of Tengyueh, *Forrest 9671* (AA, ISOTYPE).

The very deep and narrow-based lobes of the leaves easily separate this species from its allies. It is nearest to *B. hispida* Seem.; aside from the leaf-characters, it differs from the latter in that the petals are white-tomentose outside and the inflorescence is not prickly.

5. **Brassaiopsis palmipes** Forrest ex Smith, Notes Bot. Gard. Edinb. **10:** 12. 1917; Hand.-Maz. Symb. Sin. **7:** 694. 1933.

A prickly shrub 3–9 m. tall, with submembranaceous palmately 8–11-lobed leaves, the lobes subspinulose-serrulate, narrowed at the base, forming broadly winged pseudopetiolules, and with pubescent to glabrescent panicles formed by many-flowered umbels. Leaves lobed to $\frac{4}{5}$ the length, petiolate, stipulate, the base cordate; lobes 8–11, oblong-elliptic, 10–15 cm. long, 5–7.5 cm. wide, the apex rounded to acute, the base rounded, with pseudopetiolules joined by broad wings, the margins subspinulose-serrulate, glabrous or slightly pubescent above, densely pubescent to glabrescent beneath, the lateral nerves distinct above, prominent beneath; petioles 12–25 cm. long, ferruginous-pubescent at first, soon glabrescent, with few prickles at the apex; stipules united, the apices free, lanceolate. Inflorescence a large panicle, pubescent to glabrescent, the flowers in umbels, the umbels many-flowered, 3–5 cm. in diameter; peduncles 2 cm. long, the pedicels ferruginous-puberulous, 1 cm. long. Calyx 3 mm. long, 5-dentate, the teeth short, acute. Petals 5, pubescent outside, 4 mm. long. Ovary mostly 2- sometimes 3-celled, the styles united into a column. Fruit ovoid, 8 mm. long, 5 mm. broad, the style-column 2 mm. long.

YUNNAN: Shweli Valley, *Forrest 7887* (ISOTYPE, AA); Shangpa, *H. T. Tsai 56575* (AA) (fruit).

A species apparently close to *B. fatsioides* Harms. Its *Trevesia*-like leaves are unique and very distinct.

6. **Brassaiopsis ficifolia** Dunn, Jour. Linn. Soc. Bot. **35:** 500. 1903; Chung, Mem. Sci. Soc. China **1:** 187. 1924.

A very low slightly prickly shrub, 1–1.5 m. tall, with membranaceous palmately 3- or rarely 4–6-lobed leaves, the lobes serrate, and with ferruginous-tomentose

panicles formed by many-flowered umbels. Leaves about 20 cm. across, petiolate, stipulate, the base cordate; lobes ovate, generally 3, rarely 4–6, 10–14 cm. long, 6–9 cm. wide, the apex acuminate, the base narrowed, the margins serrate, glabrous above, glabrous or sparsely stellate-tomentose beneath; petioles glabrous, 8–10 cm. long; stipules short, connate within the petioles, with 2 distinct triangular erect lobes. Inflorescence a panicle, ferruginous-tomentose, the flowers in umbels, the umbels 3 cm. in diameter, many-flowered; peduncles 3.5 cm. long; pedicels 1.2 cm. long. Calyx tomentose, 2 mm. long, the margin entire. Petals 5, 3 mm. long. Stamens 5, the filaments 3 mm. long. Ovary 2-celled, the disk slightly elevated, the styles united into a column, the stigmas 2, slightly divergent. Fruit didymous, globose, 8 mm. across, 2-seeded or by abortion 1-seeded, the disk small, truncate, the style-column 2 mm. long.

YUNNAN: Szemao, *Henry 11650* (isosyntype, AA), *12653* (isosyntype, W), *12653A* (isosyntype, AA, NY), *12653B* (isosyntype, AA, NY, W); Dzung-deui, Champutong, *C. W. Wang 66927* (AA).

The leaves are variable in shape. While most of the leaves are trilobed, there are also a few with 4–6 lobes. The lobes may be broad or narrow, extending from ¼ to ½ the length of the leaves.

7. **Brassaiopsis fatsioides** Harms in Sargent, Pl. Wils. **2**: 556. 1916; Chung, Mem. Sci. Soc. China **1**: 187. 1924.

Brassaiopsis trevesioides W. W. Smith, Notes Bot. Gard. Edinb. **10**: 13. 1917, syn. nov.

A shrub 1–3 m. tall, with membranaceous to chartaceous palmately 7–9-lobed leaves, the lobes minutely serrulate, and with elongated puberulous panicles formed by many-flowered umbels. Leaves petiolate, the base cordate; lobes 7–9, oblanceolate to oblong-oblanceolate, divided to ⅘ the length of the leaf, 16–22 cm. long, 3–8 cm. wide, the apex short-acuminate, the base slightly narrowed, the margins serrulate, sparsely bristly to subglabrous above, slightly ferruginous-tomentose to glabrous beneath, the lateral nerves distinct on both surfaces, the tertiary veins obscure above, distinct beneath; petioles subglabrous, sparsely puberulous near the apex, 30 cm. or more long. Inflorescence in elongated panicles, the main axis puberulous, the flowers in umbels, the umbels many-flowered, 4 cm. in diameter, the peduncles puberulous, 2–3 cm. long, the pedicels subglabrous to puberulous, 0.5–1.5 cm. long. Calyx glabrous to subglabrous, the margin indistinctly dentate. Petals 5, acute, glabrous on both surfaces, 3.5–4 mm. long. Stamens 5. Ovary 2-celled, the disk thick, hemispherical, the styles united into a column. Fruit globose, 5–6 mm. across, 2-seeded, the disk about ⅙ the length of the fruit, the style-column 2 mm. long, the pedicels 1.5 cm. long.

SZECHUAN: Without precise locality, *Wilson 3697* (ISOTYPE, AA); Ma-pien Hsien, *F. T. Wang 23098* (AA); Omei-shan, *Chiao & Fan 538* (AA).

YUNNAN: Chiu-pei Hsien, *H. T. Tsai 51423* (AA); Mong Ka, *H. T. Tsai 56307* (AA); Chen-ka Hsien, *C. W. Wang 72290* (AA), *72452* (AA); Fo-hai Hsien, Hai-lung-tarn, *C. W. Wang 76297* (AA); Shunning, Hila, Wumulung, *T. T. Yü 16666* (AA); Taron-Taru Divide, Lungnan, *T. T. Yü 20009* (AA).

The Yunnan specimens cited above are generally larger plants to 7–8 m. tall; otherwise the characters are the same as in the Szechuan specimens. *Tsai 56307* has leaves with stronger, occasionally doubly serrate, more or less spinose-serrate margins.

A species related to *Brassaiopsis ciliata* Dunn, from which it differs primarily in the absence of prickles on the inflorescence. Both species are apparently closely allied to the Indian *B. mitis* C. B. Clarke. Smith's *B. trevesioides* is here reduced to synonymy on the basis of photographs and fragments of flowers from the type (in AA).

8. **Brassaiopsis tripteris** (Lévl.) Rehder, Jour. Arn. Arb. **15:** 115. 1934.

Heptapleurum tripteris Lévl. Bull. Acad. Géogr. Bot. **34:** 145. 1914; Fl. Kouy-Tchéou 35. 1914; Ill. Pl. Seu-Tchéouen *t. 1.* 1918, in ms.

A very low shrub with digitately compound leaves, the leaflets 3, chartaceous, sessile, obovate-oblong, spinosely serrulate and glabrous, and with a small terminal few-umbellate panicle. Leaves petiolate, stipulate; leaflets 3, sometimes with an additional lobe, about 13 cm. long and 5 cm. wide, the apex acute to acuminate, the base long-attenuate, the margins spinose-serrulate, glabrous on both surfaces, the lateral nerves about 6 on each side, subconspicuous above, prominent beneath; petioles about 11 cm. long, glabrous; stipules united, the apices free, acuminate. Inflorescence a small terminal few-umbellate panicle, ferruginous-tomentose to glabrescent, the umbels many-flowered, about 3.5 cm. in diameter, the peduncles 4.5 cm. long, the bracts 5–7 mm. long, acuminate, the pedicels slender, 1.5 cm. long. Calyx tomentose, 2 mm. long, the margin 5-dentate. Petals 5, ovate, 3 mm. long, glabrous on both surfaces. Ovary 2-celled, the disk elevated; styles united into a column, 2 mm. long.

Kweichow: West of Lo-fou, *J. Cavalerie 2566* (holotype of *Heptapleurum tripteris* Lévl.; merotype in AA).

9. **Brassaiopsis chengkangensis** Hu, Bull. Fan. Mem. Inst. Biol. Bot. Ser. **10:** 162. 1940.

A tree to 15 m. in height, with digitately compound leaves, the leaflets 3–7, coriaceous, petiolulate, ovate-oblong to lanceolate, remotely mucronate-denticulate, ferruginously bristly, and with ferruginously bristly panicles formed by many-flowered umbels. Leaves petiolate; petioles stout, terete, densely and softly ferruginous-bristly with branching bristles to 3 mm. long when young and finally sparsely stellate-tomentose, to 30 cm. long; leaflets densely ferruginous-bristly when young, at length glabrescent above and sparsely bristly beneath, ovate-oblong to oblong-lanceolate, 15–29 cm. long, 6–13 cm. wide, the apex acuminate, the base rounded, the margins remotely mucronate-denticulate toward the upper part, the lateral nerves about 18 on each side, distinct above, projecting beneath, the tertiary veins slightly impressed above, projecting beneath; petiolules stout, densely ferruginous-bristly, 1.5–2.5 cm. long. Inflorescence racemose-paniculate, to 35 cm. long, the main axis very stout, densely bristly, the flowers in many-flowered umbels, these 3.5 cm. in diameter, the peduncles 2.5–5 cm. long; pedicels to 8 mm. long, ferruginous-bristly, with persistent ligulate bracteoles at the base. Calyx densely ferruginous-bristly, 2.5 mm. long, with 5 linear-lanceolate membranaceous lobes, the margins fimbriate. Petals 5, ovate, 3 mm. long, densely ferruginous-bristly outside. Stamens 5, 2 mm. long. Ovary 2-celled, the disk thick, the styles united into a stout column, 1.2 mm. long.

Yunnan: Chenkang Hsien, *C. W. Wang 72309* (isotype, AA); Mong-ka, *H. T. Tsai 56386* (AA); Shunning, Snow Range, *T. T. Yü 16006* (AA).

A species characterized by the dense ferruginous-bristly indumentum.

10. **Brassaiopsis gracilis** Hand.-Maz. Sinensia **3:** 197. 1933.

A shrub about 1 m. tall, with digitately compound leaves, the leaflets 5, membranaceous, petiolulate, ovate- to elliptic-lanceolate, sparsely setose above, and with an axillary, small, ferruginous-tomentose inflorescence formed by few umbels. Branches glabrous, occasionally with a single prickle at the nodes, the prickles straight, conical. Leaves petiolate; petioles slender, glabrous, about 10–15 cm. long; leaflets subsessile to short-petiolulate, sparsely short-setose above, glabrous beneath, 8–18 cm. long, 3–5 cm. wide, the apex long-acuminate, the base attenuate, the lateral ones often oblique, the margins serrate, the lateral nerves about 4–6 on each side, prominent, the tertiary veins obscure; petiolules 0–13 mm. long. Inflorescence in an axillary small raceme formed by few umbels, about 7–8 cm. long, densely ferruginous-tomentose; umbels many-flowered, about 1.5

cm. in diameter, the peduncles about 2 cm. long, the bracts triangular, 3–6 mm. long, submembranaceous, the pedicels 4 mm. long, ferruginous-tomentose. Calyx glabrous, the margin 5-dentate. Petals 5. Stamens 5. Ovary 2-celled, the styles united into a single column.

KWANGSI: Tsin Hung Shan, northern Hin Yen, *R. C. Ching 6850* (ISOTYPE, LU, NY).

The specimens on which Handel-Mazzetti based his description are very young. In general appearance this species suggests some species of *Acanthopanax*. Moreover the pedicels seem to be very slightly articulate. However, the two-celled ovary and the single style-column indicate *Brassaiopsis*. Without fruiting material, it is difficult to ascertain its exact taxonomical position.

Fig. 9. *Brassaiopsis acuminata; 1.* leaf, × ½; *2.* portion of infructescence, × ½; *3.* flower, × 3; *4.* fruit, × 2.

11. **Brassaiopsis acuminata** sp. nov. Fig. 9.

Frutex circa 2–3 m. altus. Foliis digitatim compositis petiolatis; petiolis gracilibus teretibus subferrugineo-tomentosis, ad 30 cm. longis; foliolis 7–9, supra glabris, subtus sparse ferrugineo-tomentosis, chartaceis, ovato-lanceolatis, 9–18 cm. longis, 2.5–4.5 cm. latis, apice longe acuminatis, basi attenuatis, margine

subintegris vel ad partem superam remote serrulatis, nervis lateralibus utrinsecus circa 8, supra manifestis, subtus prominentibus, venis tertiariis utrinque prominentibus; petiolulis gracilibus subferrugineo-tomentosis 1–4.5 cm. longis. Inflorescentiis e paniculis gracilibus laxis, floribus umbellatis, umbellis circa 10-floris 4 cm. diametro; pedunculis subferrugineo-tomentosis 4 cm. longis; pedicellis gracilibus subferrugineo-tomentosis 1.5 cm. longis. Calycis tubo lato ferrugineo-tomentoso obscure 5-dentato. Petalis 5 ovatis tenuibus, extus parcius tomentosis, intus glabris, 5 mm. longis. Staminibus 5, filamentis 3 mm. longis. Ovario 2-loculari, disco crasso hemisphaerico, stylis in columnam circa 1.5 mm. longam connatis. Fructu didymo-globoso circa 8 mm. magno, 2-spermo, disco ⅓ fructus longitudinis aequante, stylo 3 mm. longo, stigmatibus capitatis, pedicellis ad 3 cm. longis.

YUNNAN: Kiukiang Valley, Taron, Sronwang, *T. T. Yü 20158* (TYPE, AA), Sept. 7, 1938; Kiukiang Valley, Srowtu, *T. T. Yü 20159* (AA) (fruit).

KWEICHOW: Tushan, *Y. Tsiang 7046* (NY).

A species related to *Brassaiopsis glomerulata* (Bl.) Regel, differing in the small, narrow, ovate-lanceolate, long-acuminate leaflets, the loose slender panicles, and the long pedicels.

12. **Brassaiopsis shweliensis** W. W. Smith, Notes Bot. Gard. Edinb. **10**: 13. 1917.

This species, of which I have seen no material, was described from Yunnan by W. W. Smith. Only a photograph of the type is available (in AA). W. W. Smith's original description is as follows:

"Species affinis *B. aculeatae* Seem. a qua foliolis coriaceis facile distinguenda est.

"Frutex circ. 7.5 m. altus ramis crassissimis hic illic aculeatis. Folia ampla petiolo ad 40 cm. longo ferrugineo-tomentoso cito glabrescente praedita digitata; petioluli circ. 1 cm. longi ferrugineo-tomentelli mox subglabri; foliola 6–7, ad 24 cm. longa, ad 7 cm. lata, apice plus minusve longe acuminata, basi anguste cuneata, margine (dimidio superiore) indurato-serrata, coriacea, primum tomento stellato ferrugineo vel albido conspersa, tadem glabra; costa nervique 12–15 paria subtus eminentes reticulo nervulorum subconspicuo. Inflorescentia ampla circ. 30 cm. longa; rachis crassa primum tomentella mox glabrescens rugosissima unde oriuntur fere recto angulo pedunculi numerosi circ. 2.5 cm. longi-crassi umbellam multiflorum solitariam gerentes, bracteis circ. 1.5 cm. longis coriaceis persistentibus cymbiformibus incurvis apice indurato-acutatis praediti; pedicelli circ. 1 cm. longi ferrugineo-tomentelli. Calycis dentes circ. 7 mm. longi acuti; petala non visa; fructus globosus circa 7 mm. diametro bilocularis, tomento tenui crustaceo tadem deciduo indutus, disco hemisphaerico stylo simplici 2 mm. longo.

" 'China:—Shweli Valley, Yunnan. Lat. 25° N. Alt. 6000 ft. Shrub of 25 ft. In fruit. Open situations in thickets. July 1912.' G. Forrest. No. 8702."

13. **Brassaiopsis glomerulata** (Bl.) Regel, Gartenfl. **12**: 275. *t. 411.* 1863; Merr. Lingnan Sci. Jour. **5**: 140. 1927; Hand.-Maz. Symb. Sin. **7**: 694. 1933; Chun, Sunyatsenia **4**: 248. 1940.

Aralia glomerulata Bl. Bijdr. 872. 1826.

Hedera floribunda Wall. List, no. 4912A. 1832, *nomen nudum;* G. Don, Gen. Syst. **3**: 394. 1834; Walp. Rep. **2**: 432. 1843.

Brassaiopsis speciosa Decne. & Planch. Rev. Hort. IV. **3**: 106. 1854; Seem. Jour. Bot. **2**: 262. 1864, Revis. Heder. 19. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 737. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 425. 1911.

Macropanax glomerulatum Miq. Fl. Ind. Bat. **1**(1): 764. 1855.

Brassaiopsis floribunda Seem. Jour. Bot. **2**: 262. 1864, Revis. Heder. 19. 1868.

A shrub or small tree, 3–10 m. tall, with digitately compound leaves, the leaflets 5–9, chartaceous, petiolulate, elliptic-oblong, entire or distantly serrulate,

with ferruginous-tomentose to glabrescent panicles, the flowers in umbels, racemosely arranged on the branches. Upper part of the branches prickly, reddish ferruginous-tomentose on young branches. Leaves petiolate; petioles slender, terete, glabrous, 30–50 cm. long; leaflets 15–25 cm. long, 6–10 cm. wide, the apex acuminate, the base generally cuneate, rarely obtuse to rounded, the margins entire or distantly serrulate, scattered-reddish-ferruginous-stellate-tomentose when young, soon glabrous above, glabrescent or nearly so beneath, the lateral nerves about 7–9 on each side, the tertiary nerves slightly conspicuous; petiolules long, slender, glabrous, 2–9 cm. long. Inflorescence in large panicles, 30 cm. or more long, reddish-ferruginous-tomentose when young, the rachis soon glabrescent, the flowers in umbels, these racemosely arranged on the branches, the bracts oblong or lanceolate, 5 mm. long, persistent, the peduncles 2–5 cm. long, with a bracteole at the base and 1 or 2 inserted near the middle; pedicels 1–1.2 cm. long, rising from a dense cluster of bracteoles 1–2 mm. long, reddish-ferruginous-tomentose, and persistent. Calyx-tube short, tomentose outside, 5-dentate. Petals 5, oblong, glabrous on both surfaces, 3 mm. long. Stamens 5, the filaments shorter than the petals. Ovary 2-celled, the disk convex, the styles united into a short conical column. Fruit didymo-globose or semiglobose, about 6–10 mm. across, 2-seeded, the disk convex, elevated, about ¼ to ⅓ the length of the fruit, the style-column 1–2 mm. long, the pedicels 1.2–1.5 cm. long.

YUNNAN: Mengtze, *Henry 9654A* (AA), *11492* (AA); Szemao, *Henry 13456* (AA, NY), *13621* (NY); Ping-pien Hsien, *H. T. Tsai 62236* (AA); Che-li Hsien, You-louh Shan, *C. W. Wang 78126* (AA); Chiukiang, west of Champutong, *C. W. Wang 67539* (AA); Fo-hai, *C. W. Wang 74398* (AA), *74909* (AA); Che-li Hsien, Mann-bang, Da-meng-lung, *C. W. Wang 77446* (AA); Che-li Hsien, Ban-chiou-chian, *C. W. Wang 79773* (AA); Salwin Valley, northeast of Champutong, *T. T. Yü 19162* (AA).

KWANGSI: Shang-sze District, Shap Man Taai Shan, Tang Lung Village, *W. T. Tsang 24160* (AA, NY); Yao Shan, *C. W. Wang 39913* (AA).

HAINAN: Southern slope of Five Finger Mts., *F. A. McClure 8878 = CCC9434* (NY); Hung Mo Tung, *Tsang & Fung 640 = LU18174* (NY); Dung Ka, *N. K. Chun & C. L. Tso 43935* (AA, NY, W); Chang-kang District, Ngo-ko Shan, near Tsat Cha Village, *S. K. Lau 1888* (AA, NY); no precise locality, *C. W. Wang 33684* (AA, NY, W), *34616* (NY), *35441* (NY); Yaichow, *H. Y. Liang 62558* (AA, NY), *62613* (NY); Kan-en District, Chim Fung Ling, near Sam Mo Watt Village, *S. K. Lau 3869* (AA), *4998* (AA); Lokwei, *F. C. How 72312* (AA); Po-ting, *F. C. How 73107* (AA), *73522* (AA); Bak-sa, *S. K. Lau 25479* (AA).

ADDITIONAL DISTRIBUTION: India to Indo-China and Java.

This species is very variable in its leaves, tomentum, and inflorescence. The differences, although quite great in some cases, are gradual and not constant enough for specific separation. The following varieties are recognized.

13a. **Brassaiopsis glomerulata** var. **brevipedicellata** var. nov.

A typo foliolis longioribus, apice rotundato et abrupte apiculato, pedicellis fructigeris multo brevioribus separatur.

A shrub 3–7 m. in height. Leaves 5–9-foliolate, the leaflets ovate-oblong, 14–18 cm. long, 4–6.5 cm. wide, the apex shortly and abruptly acuminate, the base broad-cuneate to rounded, the margins entire or nearly so, glabrous above, scattered ferruginous-tomentose beneath. Pedicels of fruit 5–7 mm. long.

YUNNAN: Jenn-yeh Hsien, Meng-him, *C. W. Wang 80107* (AA); Kiukiang Valley, south of Srowtu, *T. T. Yü 20156* (TYPE, AA), Nov. 21, 1938.

Differs from the species in the longer leaflets, with rounded short abruptly acuminate apex, and the much shorter pedicels in the fruit. The Chinese plant resembles var. *subovata* C. B. Clarke of India, so far as I can determine from the published description, but has smaller leaves. I cannot compare the length of the pedicels of Clarke's variety with those of mine, because, unfortunately, Clarke does not describe them.

13b. **Brassaiopsis glomerulata** var. **coriacea** (W. W. Smith) comb. nov.

Brassaiopsis coriacea W. W. Smith, Notes Bot. Gard. Edinb. **10**: 11. 1917.

A shrub 4–10 m. tall, the leaflets 7–9, coriaceous, elliptic, to 22 cm. long and 9 cm. broad, the apex short-acuminate, the base broad-cuneate to rounded, the margins entire or nearly so. Inflorescence to 60 cm. long, generally corymbose-paniculate, ferruginous-tomentose to glabrous. Pedicels of fruit about 1 cm. long.

YUNNAN: Shang-pa Hsien, *H. T. Tsai 54759* (AA), *59086* (AA); Ping-pien Hsien, *H. T. Tsai 55495* (AA), *60332* (AA), *61147* (AA); Lan-tsang Hsien, *C. W. Wang 76489A* (AA).

Differs from the species in the more coriaceous leaflets and the generally corymbose-paniculate inflorescence.

13c. **Brassaiopsis glomerulata** var. **longipedicellata** var. nov.

A typo inflorescentiis corymboso-paniculatis et fructibus longe pedicellatis differt.

A shrub 2–7 m. tall. Leaflets 5–7, subchartaceous, ovate-elliptic, 8–18 cm. long, 3–6.5 cm. wide, the apex acuminate, the base obtuse, the margins finely serrulate to entire, red-ferruginous-tomentose on both surfaces when young, soon glabrous; petiolules 1–3 cm. long. Inflorescence corymbose-paniculate, red-ferruginous-tomentose at first, soon glabrescent; pedicels of fruit 2.5 cm. long.

KWEICHOW: Chengfeng, Wong-moo, *S. W. Teng 90995* (AA).

KWANGSI: Tsin Hun Shan, north of Hin Yen, *R. C. Ching 6793* (LU, NY); Ling Wun District, *S. K. Lau 28695* (TYPE, AA), July 18, 1937.

Differs from the species in the corymbose-paniculate inflorescence and the long pedicels.

Doubtful and Excluded Species

1. **Brassaiopsis Hookeri** C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 737. 1879; Hand.-Maz. Symb. Sin. **7**: 694. 1933.

An Indian species doubtfully recorded by Handel-Mazzetti from Yunnan.

2. **Brassaiopsis palmata** (Roxb.) Kurz, Jour. As. Soc. Bengal **39**(2): 77. 1870, For. Fl. Brit. Burma **1**: 537. 1877; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Hand.-Maz. Symb. Sin. **7**: 693. 1933.

Panax palmata Roxb. Hort. Bengal. 21. 1814, Fl. Ind. ed. 2. **2**: 74. 1832.

Recorded by Chung and Handel-Mazzetti from Yunnan. Chinese specimens in the herbaria seen by me bearing the label of *Brassaiopsis palmata* (Roxb.) Kurz are found to represent *B. Hainla* Seem. This Indian species therefore should probably be excluded from the Chinese flora.

3. **Brassaiopsis papayoides** Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61**: 120. 1925, Symb. Sin. **7**: 693. 1933.

Handel-Mazzetti described *B. papayoides* from immature specimens from Yunnan and Kweichow. He does not mention the number of cells in the ovary but states "corolla juvenilis crassa conum 10-sulcatum formans," which indicates that the plant is probably not a *Brassaiopsis*. On the basis of a photograph of the type (in AA) and of the original description, the plant seems to agree well with the specimens from Kweichow cited under *Trevesia palmata* Vis. A final disposition can not be made until the type is examined.

IX. MACROPANAX Miquel

Macropanax Miq. Fl. Ind. Bat. **1**(1): 763. 1855.

Small unarmed trees. Leaves digitately compound, the leaflets entire or serrate; stipules shortly connate within the petiole or wanting. Flowers polygamous,

in umbels, the umbels arranged in large branching panicles, the bracts small, deciduous, the pedicels articulate under the flower. Calyx-margin 5-dentate. Petals 5, valvate. Stamens 5, the anthers oval. Ovary 2-, seldom 3-celled, striate or ribbed; seeds compressed; endosperm ruminate.

Two or three species from India to Java.

Type species: *Macropanax oreophilus* Miq.

Key to Species and Variety

A. Leaflets usually denticulate-serrate, the panicle-branches spreading, ferruginous-pubescent. 1. *M. oreophilus.*

AA. Leaflets entire or nearly so, the panicle-branches ascending, glabrous.

B. Umbels many, racemosely arranged on the panicle-branches .....2. *M. undulatus.*

BB. Umbels single, terminating each panicle-branch .....2a. *M. undulatus* var. *simplex.*

1. **Macropanax oreophilus** Miq. Fl. Ind. Bat. 1(1): 764. 1855; Seem. Jour. Bot. 2: 294. 1864, Revis. Heder. 20. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. 2: 738. 1879; Dunn, Jour. Linn. Soc. Bot. 39: 466. 1911; Viguier in Lecomte, Fl. Gén. Indo-Chine 2: 1164. *f. 137, no. 7, 8, f. 138, no. 1, 2.* 1923; Chung, Mem. Sci. Soc. China 1: 187. 1924; W. W. Smith, Notes Bot. Gard. Edinb. 17: 275, 326. 1930.

Macropanax floribundus Miq. Fl. Ind. Bat. 1(1): 764. 1855.

A tree about 10 m. tall, with 5–7-foliolate leaves, the leaflets oblong and elliptic to lanceolate, denticulate-serrate or crenulate, and with ferruginous-stellate-tomentose compound panicles with spreading branches. Leaves petiolate, the petioles terete, glabrous, 10–15 cm. long; leaflets chartaceous, petiolulate, 10–15 cm. long, 3–4 cm. wide, the apex acuminate, the base rounded to acute, the margins denticulate-serrate or crenulate, glabrous on both surfaces, the lateral nerves 6–10 on each side, distinct on both surfaces, the tertiary veins conspicuous above, inconspicuous beneath; petiolules 1–2 cm. long. Inflorescence a terminal compound panicle to 30 cm. long, ferruginous-stellate-tomentose, the branches about 10 cm. long, spreading, the bracts inconspicuous or caducous. Calyx glabrous, the margin inconspicuously dentate. Petals 5, glabrous on both surfaces, 1.5 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 2-celled, the styles united into a column, the disk elevated, hemispherical. Fruit ovoid, slightly ribbed, 5 mm. long, the disk large, conical, often wider than the top of the fruit, the style-column persistent, 2–3 mm. long.

Yunnan: Szemao, *Henry 13082* (NY), *13083* (AA, W), *13083A* (AA, NY); no precise locality, *Forrest 8267* (AA), *8796* (AA), *11822* (AA); Shweli-Salween divide, *Forrest 17690* (AA), *18289* (AA); Lung-ling Hsien, *H. T. Tsai 54588* (AA); Fo-hai, *C. W. Wang 77261* (AA); Meng-soong, Dar-meng-lung, Che-li Hsien, *C. W. Wang 78358A* (AA).

Hainan: No precise locality, *H. Y. Liang 64212* (AA, NY, W) (juvenile), *C. W. Wang 36325* (AA, NY) (juvenile).

Additional distribution: India to Malaya.

2. **Macropanax undulatus** (Wall.) Seem. Jour. Bot. 2: 294. 1864, Revis. Heder. 20. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. 2: 738. 1879; Dunn, Jour. Linn. Soc. Bot. 39: 466. 1911; Chung, Mem. Sci. Soc. China 1: 187. 1924; Merr. Lingnan Sci. Jour. 11: 49. 1932.

Hedera undulata Wall. List no. 4916A. 1832, *nomen nudum;* G. Don, Gen. Syst. 3: 394. 1834; Walp. Rep. 2: 432. 1843.

Macropanax concinnus Miq. Ann. Mus. Bot. Lugd.-Bat. 1: 220. 1864; Viguier in Lecomte, Fl. Gén. Indo-Chine 2: 1165. 1923.

A tree to 15 m. tall, with 3–5-foliolate leaves, the leaflets elliptic-lanceolate, entire or rarely minutely denticulate, and with glabrous, terminal, compound panicles, the branches ascending. Leaves petiolate; petioles slender, terete, glabrous, 10–15 cm. long; leaflets chartaceous, petiolulate, 10–18 cm. long, 3.5–5.5 cm. wide, the apex acuminate, the base acute to rounded, the margins entire, rarely minutely denticulate, glabrous on both surfaces, the lateral nerves about 6

on each side, conspicuous beneath, subconspicuous above, the tertiary nerves inconspicuous; petiolules 1.5–3 mm. long, the lateral ones very short. Inflorescence a terminal compound panicle, 15–30 cm. long, glabrous, the branches 10–12 cm. long, ascending, the compound bracts triangular, 3 mm. long, caducous, the flowers in umbels, the peduncles 0.5–1 cm. or more long, the pedicels 3–5 mm. long, glabrous, articulate under the flower, the bracteoles inconspicuous or caducous. Calyx glabrous, inconspicuously dentate. Petals 5, glabrous on both surfaces, 3 mm. long. Stamens 5, the filaments about the same length as the petals. Ovary 2-celled; styles united into a column; disk elevated. Fruit ovoid, ribbed, 5 mm. long, the disk conical, prominent, the style-column persistent, 2–3 mm. long.

YUNNAN: Between Sadon and the Yunnan Chinese border at Changtifang and Kambaiti, *J. F. Rock 7433* (AA); between Tengyueh and the Burmese border, en route to Sadon, *J. F. Rock 7384* (AA, W); Lan-Tsang Hsien, *C. W. Wang 76450* (AA); Mong-ka, *H. T. Tsai 56823* (AA); Kiukiang Valley, Taron, Sronwang, *T. T. Yü 20163* (AA); Kiukiang Valley, Muhionga, *T. T. Yü 20487* (AA).

KWEICHOW: Tuhshang, *Y. Tsiang 7044* (AA, NY, W).

KWANGSI: Nor Yut, Taiching Shan, *S. P. Ko 55386* (AA).

HAINAN: Hung Mo Shan and vicinity, *Tsang, Tang and Fung 146 = LU17677* (AA, NY, W), *303 = LU17837* (AA, NY, W); Ling-shui District, Fen Maan Ts'uen and vicinity, *McClure 20125* (AA, NY, W).

ADDITIONAL DISTRIBUTION: India to Burma and Indo-China.

This species can be distinguished from *Macropanax oreophilus* Miq. primarily by its leaflets, which are entire or nearly so, and its glabrous inflorescences with the branches ascending instead of spreading.

2a. **Macropanax undulatus** var. **simplex** var. nov.

A typo inflorescentiis racemose ramosis, ramulis simplicibus, umbella terminali differt.

YUNNAN: Szemao, *Henry 11764* (AA, NY), *12402* (AA), *12644* (AA, W), *12644B* (AA, NY), *12644C* (AA, W), *13448* (AA); between Muang and Keng Hung, *J. F. Rock 2472* (AA, W); Monka, *H. T. Tsai 56855* (AA); Fo-hai, *C. W. Wang 74850* (AA), *76149* (AA), *77147* (AA); Che-li Hsien, Sheau-meng-yeang, *C. W. Wang 75889* (TYPE, AA), Sept. 1936; Che-li Hsien, Maan-bang, Dah-meng-lung, *C. W. Wang 77469* (AA); Che-li Hsien, Dah-meng-lung, *C. W. Wang 77717* (AA), *77938* (AA); Che-li Hsien, You-louh-shan, *C. W. Wang 78130* (AA); Che-li Hsien, Jahlesi, *C. W. Wang 79174* (AA); Che-li Hsien, Kuen-ger, *C. W. Wang 79305* (AA); Che-li Hsien, Ban-chion-chian, *C. W. Wang 79697* (AA); Jenn-yeh Hsien, Lung-huk, *C. W. Wang 80155* (AA); Luh-shuen Hsien, Maan-tsang, Sheau-meng-yeang, *C. W. Wang 81102* (AA).

Differs from the species in the racemosely branched inflorescence, its branches simple with a single terminal umbel.

X. MERRILLIOPANAX Li

Merrilliopanax gen. nov.

Frutex sempervirens inermis, glaber vel mox glabrescens. Foliis simplicibus, petiolorum basi valde dilata plerumque in stipulas abeunte. Inflorescentiis terminalibus et in axillis superioribus, paniculatis, laxis, erectis, apertis. Floribus umbellatis, umbellis paucis in ramis primariis plerumque racemose dispositis, longe pedunculatis; pedicellis exarticulatis. Calycis limbo minute 5-dentato. Petalis 5 aestivatione valvata. Staminibus 5. Ovario 2-loculari, loculis 1-ovulatis, stylis 2 liberis vel basi subconnatis. Drupa subglobosa 2-loculari. Albumine aequabili.

Distribution: Northeastern India and Yunnan, China.

Type species: *Dendropanax Listeri* King.

This genus is near *Dendropanax* and *Nothopanax*. It resembles the former in its simple leaves and inarticulate pedicels, but can be readily distinguished by the paniculate inflorescences, the 2-celled ovaries, and the 2 distinct styles. It is evidently closer to *Nothopanax* than to *Dendropanax*, in both of which genera the type species has been placed. However, the uniformly simple leaves and the inarticulate pedicels clearly separate it from *Nothopanax*.

The genus is named in honor of Prof. E. D. Merrill, Administrator of Botanical Collections and Director of the Arnold Arboretum, Harvard University, in appreciation of his extensive work on the flora of China and assistance freely granted to numerous Chinese botanists and botanical institutions.

Fig. 10. *Merrilliopanax Listeri;* *1.* branchlet with infructescence, × ⅓; *2.* flower, with 2 petals removed, × 6; *3.* fruit, × 4; *4.* diagrammatic cross-section of fruit, × 4.

Key to Species

A. Leaves elliptic-lanceolate, subentire or denticulate, glabrous on both surfaces; pedicels 6–13 mm. long ..... 1. *M. Listeri.*

AA. Leaves ovate, mostly shallowly 2–3-lobed, with scattered stellate-tomentose hairs beneath; pedicels 3–4 mm. long ..... 2. *M. chinensis.*

1. **Merrilliopanax Listeri** (King) comb. nov. Fig. 10.

Dendropanax Listeri King, Jour. As. Soc. Bengal **67**(2): 294. 1898, Ann. Bot. Gard. Calcutta **9**: *t. 55.* 1901; Merr. Brittonia **4**: 133. 1941.

Nothopanax membranifolius W. W. Smith, Notes Bot. Gard. Edinb. **10**: 53. 1917, **17**: 114, 159, 256, 278, 309, 314. 1929–30; Nakai, Jour. Jap. Bot. **15**: 10. 1939.

Gilibertia myriantha Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **60**: 184. 1923.

Gilibertia Listeri Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **60**: 185. 1923.

Gilibertia membranifolia Hand.-Maz. Symb. Sin. **7**: 621. 1933, Oesterr. Bot. Zeitschr. **88**: 305. 1939.

A shrub 2–7 m. tall, the branches slender, glabrous to brownish, glabrescent. Leaves simple, long-petiolate, stipulate, membranaceous to subchartaceous, glabrous on both surfaces, elliptic to elliptic-lanceolate, 8–20 cm. long, 3–8 cm. wide, the apex subabruptly caudate-acuminate (acumen to 3 cm. long, straight or curved), the base broadly acute to more or less rounded, strongly 3-nerved, the margins subentire or denticulate, dark green and dull above, pale olivaceous green beneath, the lateral nerves 3–6 on each side, the tertiary veins subconspicuous on both surfaces; petioles slender, glabrous, 5–15 cm. long, dilate at base with the stipules. Inflorescence a terminal panicle 6–15 cm. long, the branches glabrous to sparsely minutely stellate-tomentose, the flowers in racemosely arranged umbels, these 4–12-flowered, the peduncles 0.5–3 cm. long, the pedicels 6–13 mm. long. Calyx 2 mm. long, sparsely stellate-tomentose, the margin minutely 5-dentate. Petals 5, triangular, 1.5–2 mm. long, glabrous on both surfaces. Stamens 5, the filaments as long as the petals. Ovary 2-celled, the styles 2, free or slightly connate at the base. Fruit subglobose, 4–5 mm. across, the disk small, 2 mm. across, the styles 2, divergent.

YUNNAN: Tengyueh, *Forrest 7704* (isoparatype of *Nothopanax membranifolius* W. W. Smith, AA), *8086* (isoparatype of *N. membranifolius* W. W. Smith, AA); Shweli-Salween divide, *Forrest 18077* (AA); no precise locality, *Forrest 24635* (W); Lu-djiang, Salween, *Handel-Mazzetti 8303* (isotype of *Gilibertia myriantha* Hand.-Maz., AA); West of Mekong, Salween watershed, *J. F. Rock 7016* (AA, NY, W); Champutong, Salween Valley, *J. F. Rock 10244* (AA, W); Shangpa Hsien, *H. T. Tsai 54353* (AA), *54386* (AA), *54950* (AA), *56557* (AA), *56583A* (AA), *58864* (AA); Der-la, Champutong, *C. W. Wang 66896* (AA); Dzung Duei, Champutong, *C. W. Wang 66979* (AA); Lung-pa-la, Champutong, *C. W. Wang 67053* (AA); Chiukiang, west of Champutong, *C. W. Wang 87084* (AA); Salween Valley, southeast of Champutong, *T. T. Yü 19136* (AA); Kiukiang Valley, Taron, *T. T. Yü 19476* (AA); Bucahwang, *T. T. Yü 20133* (AA); Mekong-Salween Divide, Londgrela, *T. T. Yü 23129* (AA).

ADDITIONAL DISTRIBUTION: Northeastern India.

This species was originally described and later redescribed and illustrated by King as *Dendropanax Listeri* from Assam, India. King's excellent illustration reveals the same characters as the Chinese plants. While most of the Chinese specimens examined by me have relatively somewhat narrower leaves than those depicted by King, and in some specimens the panicles are shorter than in the Assam plant, I feel confident that our material is referable to his species. In some of the Yunnan material with larger leaves, these very closely approximate those shown in King's plate. King's type was a fruiting specimen, the umbels described and depicted as having four or five fruits in each. This is true of most of the Chinese material, but in some specimens I have observed as many as seven to nine fruits. In flowering material there may occasionally be as many as twelve flowers in an umbel, but clearly many of these do not develop fruits.

Handel-Mazzetti described *Gilibertia myriantha* not realizing that *Nothapanax membranifolius* W. W. Smith represented the same species. Subsequently he noted the identity of the two, transferred Smith's species to *Gilibertia* and placed his *G. myriantha* as a synonym. Nakai, in his treatment of the Asiatic species of *Dendropanax* (as *Textoria*) (Jour. Jap. Bot. **15**: 1–18. 1939), notes that "*Nothopanax membranifolius* W. W. Smith . . . has umbels arranged in panicles, two divaricate styles, and small fruits (about 4 mm. in diameter), and cannot be classed under *Gilibertia* as Handel-Mazzetti did." Merrill has also noted the differences between this species and *Nothopanax* as well as *Dendropanax* and has added notes to various herbarium specimens. The differences, judging from the characters currently used for differentiating genera in Araliaceae, impress me as sufficiently great to warrant the erection of a new genus for this species.

2. **Merrilliopanax chinensis** sp. nov. Fig. 11.

Frutex erectus, ramulis pubescentibus. Foliis simplicibus longe petiolatis chartaceis, supra glabris, subtus parce stellato-tomentosis vel glabrescentibus, ovatis vel leviter 2–3-lobatis, 6–11 cm. longis, 4–9.5 cm. latis, apice acutis, basi late acutis, valde 3-nervatis, interdum 5-nervatis, 2 exterioribus haud prominulis, margine integris, lobis ¼ longitudinis foliorum, aequalibus, nervis lateralibus utrinsecus 4–5, nervis lateralibus et venis tertiariis utrinque elevatis conspicuis; petiolis gracilibus teretibus glabris, 5–13 cm. longis. Floribus ignotis. Inflores-

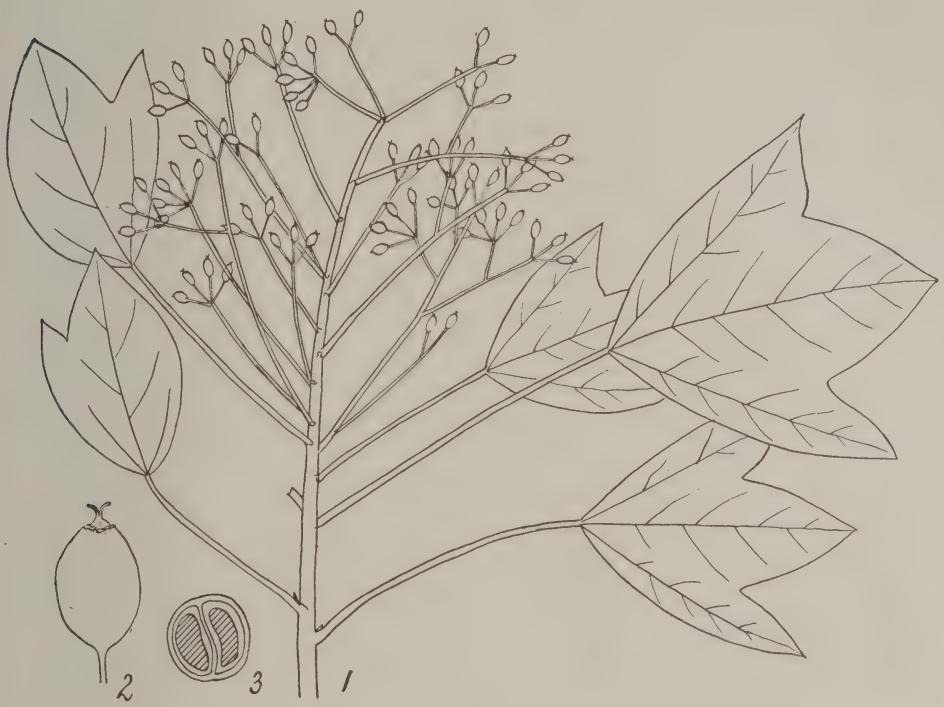

Fig. 11. *Merrilliopanax chinensis;* *1.* branchlet with infructescence, × ⅓; *2.* fruit, × 3; *3.* diagrammatic cross-section of fruit, × 3.

centiis fructigeris terminalibus paniculatis, circa 12 cm. longis, sparse minute stellato-tomentosis, fructibus umbellatis, umbellis racemosis fructus paucos gerentibus, pedunculis 1.5–3 cm. longis, pedicellis 3–4 mm. longis. Fructu (immaturo) subgloboso 3–4 mm. diametro, disco minimo 1.5–2 mm. crasso, stylis 2 divaricatis, seminibus 2.

YUNNAN: Kiukiang Valley, Taron, Timiton, *T. T. Yü 20174* (TYPE, AA), Sept. 7, 1938.

This species differs from *M. Listeri* (King) Li in its leaves being thicker, mostly 2–3-lobed, scattered stellate-tomentose beneath, the margins not toothed, and in its shorter pedicels.

XI. NOTHOPANAX Miquel

Nothopanax Miq. Fl. Ind. Bat. **1**(1): 765. 1855.

Evergreen unarmed shrubs or trees, glabrous or nearly so. Leaves digitately compound or simple and often lobed, exstipulate or with small appendages at base. Flowers in umbels, the umbels solitary, racemose, or paniculate; pedicels distinctly articulate or only very weakly so. Calyx-margin nearly entire or

5-dentate. Petals 5, valvate. Stamens 5, the anthers oval or oblong. Ovary 2- or rarely 3–4-locular. Styles 2–4, distinct or connate at base. Fruit flattened, rarely subglobose; seeds laterally compressed; endosperm uniform.

About 15 species, chiefly in Australia, a few in China.

Type species: *Nothopanax fruticosus* (Linn.) Miq. (*Panax fruticosus* Linn.).

In addition to the species enumerated below, the Indo-Chinese *Nothopanax fruticosus* (Linn.) Miq. is mentioned by Loureiro as being also cultivated in China (as *Panax fruticosus* Linn., Lour. Fl. Cochinch. 656. 1790, ed. Willd. 806. 1793). The only specimen that has come to my notice is a sterile one (Kwangtung: Canton, *W. Y. Chun 6952* [NY]) from a cultivated specimen. The species is widely distributed in cultivation in the tropics of both hemispheres, especially in Indo-Malaysia and Polynesia.

Key to Species

A. Leaves simple or 3-lobed or 2–5-foliolate; fruit flattened, the two styles connate at the base and diverging at their tips in fruit.

B. Leaves generally simple or 3-lobed, rarely 3-foliolate; leaflets when present sessile, 2.5 cm. or more broad ..... 1. *N. Davidii.*

BB. Leaves generally 2–5-foliolate, rarely simple; leaflets when present sessile to short-petiolulate, 1–2.5 cm. broad ..... 2. *N. Delavayi.*

AA. Leaves all 3–7-foliolate; fruit ovoid; styles united into a column in fruit, bifid at their tips ..... 3. *N. Rosthornii.*

1. **Nothopanax Davidii** (Franch.) Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; Harms & Rehder in Sargent, Pl. Wils. **2**: 556. 1916; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61**: 121. 1924.

Panax Davidii Franch. Nouv. Arch. Mus. Paris II. **8**: 248. (1885) 1886, Pl. David. **2**: 66. 1888, Jour. de Bot. **10**: 306. 1896.

Acanthopanax diversifolius Hemsl. Jour. Linn. Soc. Bot. **23**: 340. 1888; Lévl. Cat. Pl. Yun-Nan 11. 1915.

Nothopanax diversifolius Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 48. 1894.

Acanthopanax Davidii Viguier, Ann. Sci. Nat. IX. Bot. **4**: 41. 1906.

Nothopanax Bockii Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; Chung, Mem. Sci. Soc. China **1**: 187. 1924.

Acanthopanax Bockii Viguier, Ann. Sci. Nat. IX. Bot. **4**: 41. 1906.

Nothopanax latifolius Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61**: 121. 1924, Symb. Sin. **7**: 695. 1933, syn. nov.

A glabrous shrub or tree, to 6 m. tall, with simple or trilobed or 3-foliolate leaves, and flowers in paniculate umbels. Leaves coriaceous, petiolate, exstipulate, glabrous, green above, pale beneath, generally simple, oblong-ovate to oblong-lanceolate, 6–15 cm. long, 2.5–6 cm. wide, the apex long-acuminate, the base rounded or broad-cuneate and 3-nerved, the margins remotely serrulate, sometimes deeply 3-lobed to 3-parted or 3-foliolate, with sessile, narrow, lanceolate leaflets, the lateral nerves about 6–8 on each side, subconspicuous above, obscure beneath; petioles slender, 5–20 cm. long. Inflorescence a terminal panicle, to 18 cm. long, glabrous, the flowers in umbels, racemosely arranged on the inflorescence, the lower branches sometimes compound, the umbels 12–15-flowered, about 2.5 cm. in diameter, the peduncles 2 cm. long, the pedicels about 7 mm. long, articulate under the flower. Calyx-margin minutely 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long. Stamens 5, the filaments as long as the petals. Ovary 2-celled, the disk slightly elevated, the styles 2, connate below into a column above the middle, diverging above. Fruit flattened, 5–6 mm. across, black, the calyx-teeth usually persistent, the styles 1.5–2 mm. long, reflexed at the tip.

HUPEH: No precise locality, *Henry 2534* (NY), *2969* (AA, G), *4337* (G, NY, W), *4337A* (NY), *6608A* (G, W), *6608B* (AA), *7498* (G); Hsing-shan Hsien, *Wilson 332* (AA), *614* (AA, W), *1956* (AA, W), *1957* (AA, G, W), *1958* (AA, W), *1959* (AA, G, NY, W), *1960* (AA, G, W); Patung Hsien, *Wilson 1953* (AA, G, W); Fan Hsien, *Wilson 1952* (AA, G, W); western Hupeh, *Wilson 1564* (AA, NY, W), *2543* (NY); Liang Sung Kou, *W. Y. Chun 3794* (AA), *4140* (AA, W), *4429* (AA); Liang Kou Tai, *W. Y. Chun 4192* (W); Liu Gou Tai, *W. Y. Chun 3847* (AA); Peh Yang-tsai, *W. Y. Chun 3875* (AA); Chienshih Hsien, *H. C. Chow 1101* (AA, NY), *1341* (AA, NY), *1509* (AA), *1551* (AA, NY).

SZECHUAN: No precise locality, *E. Faber 158* (W); Muping, *Wilson 875* (AA, W); Wa-shen, *Wilson 1136* (AA, W), *1955* (AA); Wa-ssu Country and Wa-chuan Hsien, *Wilson 1954* in part (AA, W); Kuan Hsien, *W. P. Fang 2034* (AA), *2125* (AA, NY); Mt. Omei, *W. P. Fang 2246* (AA), *3106* (AA, NY), *3215* (AA, NY), *7558* (AA, NY, W), *12622* (AA); Nanchuan Hsien, *W. P. Fang 5693* (AA, NY), *C. Y. Hwang 64* (AA); Liang Feng Yah, *Steward, Chiao, & Cheo 262* (AA); Ta Ho Yen, Ran Shieh Kan, *Steward, Chiao, & Cheo 917* (AA); Kiang Yu Hsien, Kwan Wu Shan, *F. T. Wang 22255* (AA); Mt. Omei, *F. T. Wang 23654* (AA), *Y. S. Liu 1107* (AA), *K. N. Yin 163* (AA), *C. Y. Chiao & S. C. Fan 410* (AA), *786* (AA); Kuan Hsien, Chien-cheng Shan, *C. S. Fan 53* (AA); Moupin, *T. S. Wen 533* (AA).

YUNNAN: Vicum Bahan ad fluvium Lu-djang, *Handel-Mazzetti 8409* (holotype of *Nothopanax latifolius* Hand.-Maz., photo. and merotype, AA); Ping-pien Hsien, *H. T. Tsai 62457* (AA), *62493* (AA), *62632* (AA); no data, *H. T. Tsai 62881* (AA); Der-la, Champutung, *C. W. Wang 66755* (AA), *66817* (AA); Dzung-duei, Champutung, *C. W. Wang 66919* (AA); Meng-la, Jenn-yeh Hsien, *C. W. Wang 80572* (AA); Muli, Neryz to Zukou, *K. M. Feng 2911* (AA).

KWEICHOW: Kweiyang, *Y. Tsiang 8650* (NY); Shihtsien, *Y. Tsiang 4187* (NY); Tsungyi Hsien, Liang Feng Yah, *Steward, Chiao & Cheo 262* (NY); Ta Ho Yen, Fan Ching Shan, *Steward, Chiao, & Cheo 917* (NY, W).

SOUTHEASTERN TIBET: No precise locality, *Forrest 19243* (AA).

Nothopanax Davidii can be distinguished from *N. Delavayi* (Franch.) Harms by its larger leaves, which are generally simple, sometimes 3-lobed, and very rarely 3-foliolate, while *N. Delavayi* has its leaves mostly 2–5-foliolate and rarely simple. The Hupeh and Szechuan material of *N. Davidii* has the leaves all simple or lobed, never compound. The Yunnan specimens are generally closer to *N. Delavayi,* more deeply lobed and occasionally 3-foliolate, with narrower leaflets. However, in leaves that are compound, the leaflets are sessile and larger than in *N. Delavayi.* These slender and more deeply lobed forms appear to be merely local variations which it is not desirable, in my opinion, to recognize as distinct species or even as varieties. *Nothopanax Bockii* Harms and *N. latifolius* Hand.-Maz., being apparently variations of this nature, are treated here as straight synonyms.

2. **Nothopanax Delavayi** (Franch.) Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; W. W. Smith, Notes Bot. Gard. Edinb. **14**: 379. 1924, **17**: 109, 182, 400. 1929–30; Hand.-Maz. Symb. Sin. **7**: 695. 1933; Rehder, Jour. Arn. Arb. **15**: 115. 1934.

Panax Delavayi Franch. Jour. de Bot. **10**: 305. 1896, Pl. Sin. Ecl. Prim. 75. 1897; Diels, Notes Bot. Gard. Edinb. **7**: 33. 1912; Lévl. Cat. Pl. Yun-Nan 11. 1915.

Acanthopanax Delavayi Viguier, Ann. Sci. Nat. IX. Bot. **4**: 42. 1906.

Aralia Bodinieri Lévl. Bull. Acad. Géogr. Bot. **24**: 143. 1914, Fl. Kouy-Tchéou 34. 1914.

Heptapleurum Esquirolii Lévl. Bull. Acad. Géogr. Bot. **24**: 45. 1914, Fl. Kouy-Tchéou 35. 1914.

A shrub 1–5 m. tall, commonly with 3–5-digitately foliolate leaves, these occasionally simple, and with flowers in paniculate umbels. Leaves coriaceous, petiolate, exstipulate, glabrous, green above, pale beneath; petioles slender, 4–12 cm. long; leaflets 2–5, generally 3 or 5, sessile to short-petiolulate, oblong-lanceolate, 6–12 cm. long, 1–2.5 cm. wide, the apex acuminate, the base narrowly cuneate, the margins subentire to denticulate-crenate, the lateral nerves 6–8 on both sides,

inconspicuous on both surfaces; petiolules 0–1 cm. long. Inflorescence a terminal panicle, to 15 cm. long, glabrous, the flowers in racemosely arranged umbels, the lower branches sometimes compound, the umbels 12–15-flowered, 2 cm. in diameter, the peduncles 1–1.5 cm. long, the pedicels 0.5 cm. long, articulate under the flower. Calyx-margin subentire to minutely 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long. Stamens 5, the filaments 2 mm. long. Ovary 2-celled, the styles connate into a single column, the disk slightly elevated. Fruit flattened, 5 mm. across, the styles 2, 2–3 mm. long, connate at base, diverging at tip.

Sikang: We-si Hsien, Yeh-chih, *C. W. Wang 70447* (AA).

Yunnan: No precise locality, *Forrest 9590* (AA), *10691* = *10676* (AA), *10826* (AA), *11708* (AA), *11751* (AA); Salween Valley, *Forrest 6215* (AA); Chien-chuan-Mekong divide, *Forrest 23124* (AA, W); Mengtze, *Henry 9927* (NY, W), *9927B* (AA), *9927C* (AA), *9927D* (NY); San Ying Pan, *C. Schneider 395* (AA); Likiang, *C. Schneider 2236* (AA); Chungtien, *Handel-Mazzetti 4456* (AA); Tai-haosse, *O. Schoh 325* (AA, W); Pe Yen Tsin, *Simeon Ten 32* (AA), *537* (AA, W); Yangpi, *J. F. Rock 6203* (AA, W); Pinpo, *J. F. Rock 6951* (AA, NY, W); west of Likiang, near Ngaza, *J. F. Rock 10571* (AA, NY, W); Mt. Kenyichunpo and region of Champutong, *J. F. Rock 11633* (AA, W); Lan-ping Hsien, *H. T. Tsai 54028* (AA), *56134* (AA), *56278* (AA); no precise locality, *H. T. Tsai 57524* (AA); Pin-chuan Hsien, *H. T. Tsai 52942* (AA); Wei-si Hsien, *H. T. Tsai 57866* (AA), *59848* (AA), *63008* (AA), *63013* (AA); Wei-si Hsien, *C. W. Wang 67747* (AA); Huann-fu-ping, A-tung-tze, *C. W. Wang 69157* (AA); Chi-na-tung, Cham-pu-tung, *C. W. Wang 69999A* (AA); Monhua, Wipoushan, *T. T. Yü 18283* (AA); Salwin Valley, Sekai, *T. T. Yü 23059* (AA); Ta-hou-shan near Ta-koo, *K. M. Feng 624* (AA); southeast of Chungtien, between Bodo and Haba, *K. M. Feng 2069* (AA), *2423* (AA); northeastern Likiang, Tsai-koo Snow Mt., *K. M. Feng 2487* (AA); southern Chungtien, Chiao-tou on the Yangtze Bank, *K. M. Feng 3186* (AA); southern Chungtien, Wu-tso on the Yangtze, *K. M. Feng 3335* (AA); northwestern Likiang, Tamichung, *R. C. Ching 21488* (AA); northwestern Likiang, Tsze-kou on the Yangtze, *R. C. Ching 21598* (AA); northwestern Likiang, Ta-chen, *R. C. Ching 21895* (AA).

Kweichow: Pin-fa, *J. Cavalerie 871* (holotype of *Heptapleurum Esquirolii* Lévl., photo. AA); Gan-lin, *L. Martin* in *herb. Bodinier 2696* (syntype of *Aralia Bodinieri* Lévl., photo. AA).

3. **Nothopanax Rosthornii** Harms, Bot. Jahrb. **29**: 487. 1900; Harms & Rehder in Sargent, Pl. Wils. **2**: 557. 1916; Chung, Mem. Sci. Soc. China **1**: 187. 1924.

Acanthopanax Rosthornii Viguier, Ann. Sci. Nat. IX. Bot. **4**: 42. 1906.

A glabrous shrub, 5–8 m. tall, with digitately 5–7-foliolate leaves, the flowers in paniculate umbels. Leaves digitately compound, petiolate, exstipulate; petioles slender, 4–20 cm. long; leaflets 3–7, short-petiolulate, chartaceous, glabrous, dark green above, pale beneath, obovate-lanceolate, 6–12 cm. long, 1.5–3.5 cm. wide, the apex short-acuminate (acumen often curved), the base attenuate, the margins remotely denticulate-crenate to denticulate-serrate, the lateral nerves 8–10 on both sides, inconspicuous on both surfaces; petiolules 0.3–1 cm. long. Inflorescence a terminal panicle, glabrous, to 15 cm. long, the flowers in racemosely arranged umbels, on the branches of the panicle, the umbels 6–11-flowered, about 1.5 cm. in diameter, the peduncles 1–1.5 cm. long, the pedicels 5–6 mm. long, articulate under the flower. Calyx-margin subentire. Petals 5, triangular-ovate, 2 mm. long. Stamens 5, the filaments 3 mm. long. Ovary 2-celled, the disk much elevated, hemispherical, the styles united into a column. Fruit ovoid, 4 mm. long, 2.5 mm. wide, the style-column 1.5–2 mm. long, bifid at tip.

Hupeh: Without precise locality, *Wilson 2497* (AA); Hsing-shan Hsien, *Wilson 1961* in part (AA, G).

Szechuan: Hung-ya Hsien, *Wilson 1961* in part (AA, W); Mt. Omei, *Wilson 4938* (AA); Kuan Hsien, *F. T. Wang 2080* (AA).

This species can be distinguished from *Nothopanax Davidii* (Franch.) Harms and *N. Delavayi* (Franch.) Harms by its leaves being chartaceous and all 3–7-foliolate, and by having fewer flowers in the umbels, ovoid fruits, and styles

bifid only at tip in fruit. Leaves that are digitately compound can be distinguished from those of *N. Delavayi* in their leaflets being broader and widest above the middle.

XII. Acanthopanax Miquel

Acanthopanax Miq. Ann. Mus. Bot. Lugd.-Bat. **1**: 10. 1863.

Shrubs or small trees, glabrous or hairy, usually prickly, rarely unarmed. Leaves digitately compound; stipules wanting or very weakly developed. Flowers perfect or polygamous, in terminal umbels, solitary or few together, or forming large terminal panicles, the pedicels slightly or not articulate under the flower. Calyx-margin minutely 5-dentate. Petals 5, rarely 4, valvate. Stamens as many as the petals, the anthers oblong. Ovary 2, sometimes 3–5-celled. Styles 2–5, distinct or connate at base. Fruit laterally compressed or subglobose, 2–5-seeded; seeds compressed; endosperm uniform.

About 30 species in eastern Asia and the Himalayan region, one extending southward to the Philippines.

Type species: *Acanthopanax spinosus* (Linn. f.) Miq. (*Panax spinosus* Linn. f.).

Key to Species and Varieties

A. Styles 5, united throughout their whole length into a single column. (Section I. *Eleutherococcus* (Maxim.) Harms.)
B. Leaflets distinctly petiolulate.
C. Leaflets glabrous or pubescent, not setose or only very slightly so.
D. Branches usually densely covered with slender bristle-like prickles.
1. *A. senticosus.*
DD. Branches unarmed or with few and usually reflexed prickles.
E. Branches glabrous; prickles slender; peduncles usually slender, glabrous, without prickles.
F. Leaflets 5-foliolate, rarely 3–4-foliolate.
G. Leaflets glabrous .....2. *A. leucorrhizus.*
GG. Leaflets scabrous-pubescent above, fulvous-pubescent along the veins beneath.
H. Leaflets serrate or slightly double-serrate, without bristles.
2a. *A. leucorrhizus* var. *fulvescens.*
HH. Leaflets double-serrate, with setose-acuminate teeth, bristly on the petiolules and the midrib beneath .....2b. *A. leucorrhizus* var. *scaberulus.*
FF. Leaflets 3-foliolate, rarely 4–5-foliolate .....3. *A. setchuenensis.*
EE. Branches rough-pubescent at first, later glabrous, the prickles short, conical; peduncles stout and pubescent.
F. Leaflets pubescent along the veins beneath; pedicels glabrous or slightly pubescent .....4. *A. Henryi.*
FF. Leaflets glabrous beneath; pedicels very pubescent..4a. *A. Henryi* var. *Faberi.*
CC. Leaflets bristly or with setose hairs on both surfaces .....5. *A. Simonii.*
BB. Leaflets very short-petiolulate or almost sessile.
C. Petiolules short, 2–4 cm. long; leaflets obovate to oblong, small, 3.5–5.5 × 1.5–2.3 cm., the apex rounded to obtuse, the margins entire; umbels 1 or 2 .....6. *A. brachypus.*
CC. Petiolules long, 10–16 cm. long; leaflets oblong-elliptic, large, 14–17 × 5.5–8 cm., the apex acuminate, the margins serrulate-dentate; umbels more than 2.
7. *A. phanerophlebius.*
AA. Styles 2–5, divided at least at the apex.
B. Branches prickly.
C. Flowers subsessile or on short pubescent pedicels, 3–10 mm. long; styles 2. (Section II. *Cephalopanax* Baill.)
D. Styles united into a single column, bifid at tip only.
E. Leaflets usually 5, rough-pubescent beneath; pedicels 3–10 mm. long.
8. *A. divaricatus.*

EE. Leaflets usually 3, glabrous or nearly so beneath; pedicels very short, almost wanting.
F. Leaflets obovate to oblong-lanceolate, large, 8–18 cm. long; umbels 3.5 cm. across; fruit 1–1.5 cm. long .....9. *A. sessiliflorus.*
FF. Leaflets elliptic, small, 5–9 cm. long; umbels less than 3.5 cm. across; fruit 1 cm. or less long .....9a. *A. sessiliflorus* var. *parviceps.*
DD. Styles 2, united at base or to middle only; pedicels 5–7 mm. long; leaflets 3. 10. *A. lasiogyne.*
CC. Flowers slender-pedicellate, the pedicels glabrous; styles 2–5.
D. Umbels usually solitary; styles more or less united into a column or to middle or only at base. (Section III. *Euacanthopanax* Harms.)
E. Styles 3–5, free or united to middle.
F. Styles free or almost free .....11. *A. cissifolius.*
FF. Styles united at base or to above middle.
G. Styles united only at base or at most to middle.
H. Branches more or less densely prickly.
I. Prickles conical, reflexed, slightly broadened at base .....12. *A. Yui*
II. Prickles bristle-like, spreading or reflexed, narrow at base.
J. Branches densely prickly .....13. *A. Giraldii*
JJ. Branches unarmed or nearly so.
K. Leaflets obovate to obovate-oblong, glabrous, the margins irregularly double-serrate .....13a. *A. Giraldii* var. *inermis.*
KK. Leaflets lanceolate to oblanceolate, sparingly scabrid above, short-villose-pilose beneath, the margins simple-serrate. 13b. *A. Giraldii* var. *pilosulus.*
HH. Branches unarmed or prickly only at nodes.
I. Branches glabrous, unarmed or only bristle-prickly at the nodes.
J. Leaflets oblanceolate to oblong-lanceolate, 4–5.5 × 0.5–1.6 cm.; peduncles 1.5–5 cm. long .....14. *A. Wilsonii.*
JJ. Leaflets narrowly lanceolate to oblanceolate, 2–6.5 × 0.4–1.5 cm.; peduncles 1 cm. or less long .....15. *A. stenophyllus.*
II. Branches densely covered with bristles and with a single prickle at the base of petiole .....16. *A. setulosus.*
GG. Styles united to middle or above.
H. Peduncles short, 1–2 cm. long; styles united into a short conical column, their tips distinct and recurved .....17. *A. Rehderianus.*
HH. Peduncles slender, 5–10 cm. long; styles connate into a slender column nearly to apex .....18. *A. Sieboldianus.*
EE. Styles 2, free or united at base.
F. Leaflets glabrous or sometimes very slightly setulose .....19. *A. gracilistylus.*
FF. Leaflets pubescent to villose or scabrid.
G. Leaflets glabrous above, pubescent especially along the nerves beneath. 19a. *A. gracilistylus* var. *pubescens.*
GG. Leaflets glabrous to slightly setulose above, villose beneath, slightly setulose along the nerves .....19b. *A. gracilistylus* var. *villosulus.*
GGG. Leaflets scabrid-setulose above, scabrid to pubescent beneath. 19c. *A. gracilistylus* var. *nodiflorus.*
DD. Umbels usually 4–7 at ends of branches, rarely solitary; styles 2, united to middle or only at base. (Section IV. *Xanthoxylopanax* Harms.)
E. Prickles recurved at their tips; petioles scattered-prickly; peduncles 2–7 cm. long; pedicels 1 cm. long; fruit compressed.
F. Leaflets glabrous or very slightly setose along the midrib and veins above; margins serrulate .....20. *A. trifoliatus.*
FF. Leaflets more or less densely setose along the midrib and veins above; margins doubly setose-serrate .....20a. *A. trifoliatus* var. *setosus.*
EE. Prickles more or less straight; petioles unarmed; peduncles 1–2 cm. long; pedicels 5–10 mm. long; fruits very much compressed .....21. *A. Wardii.*
BB. Branches unarmed; umbels several in a raceme or compound umbel; styles 2–4, united at base or to middle. (Section V. *Evodiopanax* Harms.)
C. Leaflets glabrous, ferruginous-tomentose in axils of nerves beneath; peduncles and pedicels glabrous.

D. Leaflets 3; umbels few- to many-flowered; pedicels in fruit 1–3.5 cm. long. 22. *A. evodiaefolius.*

DD. Leaflets mostly 5; umbels few-flowered; pedicels in fruit 1–2.5 cm. long. 22a. *A. evodiaefolius* var. *gracilis.*

CC. Leaflets ferruginous-tomentose on lateral nerves beneath; peduncles and pedicels ferruginous-tomentose ..... 22b. *A. evodiaefolius* var. *ferrugineus.*

1. **Acanthopanax senticosus** (Rupr. & Maxim.) Harms in Engl. & Prantl. Nat. Pflanzenfam. 3(8): 50. 1894; Rehder in Bailey, Stand. Cycl. Hort. **1**: 193. 1914; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 7. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Lee, For. Bot. China 869. 1935.

Hedera senticosus Rupr. & Maxim. Bull. Phys.-Math. Acad. St. Pétersb. **15**: 134. 1856, 367. 1857.

Eleutherococcus senticosus Maxim. Mém. Div. Sav. Acad. Sci. St. Pétersb. **9**: 132. 1859 (Prim. Fl. Amur.); Regel, Gartenfl. **12**: 84. *t. 393.* 1863; Seem. Jour. Bot. **6**: 162. 1868, Revis. Heder. 80. 1868; Franch. Pl. David. **1**: 145. 1884; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 342. 1888; Yabe, Enum. Pl. Manch. 98. 1912; Nakai, Jour. Arn. Arb. **5**: 9. 1924, Fl. Sylvat. Koreana **16**: 31. *t. 6.* 1927; Nakai, Honda, Satake, & Kitagawa, Rep. 1st. Sci. Exp. Manch. **6**(6): 35. 1936.

Acanthopanax Eleutherococcus Makino, Bot. Mag. Tokyo **12**: 19. 1898.

A shrub 1–5 m. tall, with upright sparingly branched stems usually densely covered with prickles, 5- or sometimes 3-foliolate leaves, and terminal umbels, solitary or 2–4 arranged together. Prickles sometimes scattered, usually very slender, long, often pointing backward, narrow at base, commonly more densely arranged at bases of petioles. Leaves 5- or sometimes 3-foliolate, petiolate; petioles slender, 3–12 cm. long, with or without fine prickles; leaflets chartaceous, short-petiolulate, dark green above, with or without scattered hairs, light green beneath, commonly brownish pubescent on the veins when young, elliptic-obovate to oblong, 7–13 cm. long, 3–7 cm. wide, the median ones often slightly larger, the apex short-acuminate, the base cuneate, the margins sharply and doubly serrate, the lateral nerves about 6–7 on each side, conspicuous on both surfaces, the tertiary veins indistinct; petiolules 0.5–2 cm. long, brownish-pubescent, sometimes covered with fine bristles. Inflorescence of terminal umbels, solitary or 2–4 together, the umbels many-flowered, 3–4 cm. in diameter, the peduncles 5–7 cm. long, glabrous, the pedicels 1–2 cm. long, glabrous or slightly pubescent near base. Calyx glabrous, the margin subentire to indistinctly 5-dentate. Petals 5, ovate, 1.5 mm. long, glabrous on both surfaces. Stamens 5, the filaments 1.5 mm. long. Ovary 5-celled, the styles united into a single column. Fruit subglobose to ovoid, about 8 mm. long and 6 mm. thick, 5-angular, the style-column 1.5 mm. long.

SHANSI: Great Wall pass, *J. Hers 2604* (AA); Chiao-cheng District, Pa-shui-ko-shan, *H. Smith 7785* (AA); Lin-shih Hsien, Mien-shan, *T. Tang 982* (AA); Fangshan Hsien, Kaoti Mt., *T. Tang 1481* (AA, W).

HOPEI: Hsiao-wu-tai-shan, *F. N. Meyer 1365* (AA, NY), *1369* (AA, NY); Hsiao-wu-tai-shan, Yang-kia-ping, *H. Smith 306* (AA); Hsiao-wu-tai-shan, *J. Hers 1467* (AA); Lin Shan, *J. C. Liu 1481* (AA); Eastern Tomb, *C. F. Li 11234* (NY), *H. T. Tsai 50263* (AA); Yang-kia-ping, *C. W. Wang 60500* (AA); Hsi-ling-shan, *C. W. Wang 61060* (AA).

MANCHURIA: Amur, *Maximowicz s. n.* (NY); Amur River, *L. Schrank s. n.* (G); Chang-pei-shan to Tang-ho-ko, Sungari River, *H. E. M. James s. n.* (NY); Mukden, *V. Komarov 149* (AA, NY); Amur River, *S. Korshinsky s. n.* (G, W); eastern Siberia and Manchuria, *C. S. Sargent s. n.* (AA); east of Harbin, *C. S. Sargent s. n.* (AA); Maoershan Station, *B. V. Skvortzov s. n.* (AA); Hsiaolin, *P. H. & J. H. Dorsett 4072½* (NY, W); Kaolingtzu, *P. H. Dorsett 5984* (AA, W); Kirin, near Wochiukow, O-muhsien, *H. W. Kung 1896* (NY); Kirin, *F. H. Chen 426* (AA); Hsiaoling, *B. V. Skvortzov s. n.* (AA).

ADDITIONAL DISTRIBUTION: Korea, Sachlin, and Japan.

This species is especially characterized by its slender, usually backwardly pointed, bristle-like prickles.

1a. **Acanthopanax senticosus** f. **subinermis** (Regel) comb. nov.

Eleutherococcus senticosus β subinermis Regel, Mém. Acad. Sci. St. Pétersb. VII. **4**(4): 73. 1861 (Tent. Fl. Ussur.); Nakai, Jour. Arn. Arb. **5**: 10. 1924.

Eleutherococcus senticosus f. *inermis* Komarov, Act. Hort. Petrop. **25**: 121. 1907 (Fl. Mansh. III.).

Acanthopanax senticosus f. *inermis* Harms, Mitt. Deutsch. Dendr. Ges. **27**: 8. 1918.

Branches smooth or with very few prickles; leaves and umbels slightly larger than in the typical form.

Shansi: Yuan-chu District, Ye-cho-shan, *H. Smith 6499* (AA); Tsiliyu, Ho-schan, *E. Licent 12209* (AA).

Honan: Tsi Yuan Hsien, Tien Tan Shan, *J. Hers 1893* (AA).

Hopei: Hsiao-wu-tai-shan, Tien-ling-ssu, *H. Smith 912* (AA).

Chahar: No precise locality, *C. W. Wang 62262* (AA).

Manchuria: Mifun Station, *B. V. Skvortzov s. n.* (AA).

2. **Acanthopanax leucorrhizus** (Oliv.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 49. 1894; Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; Bean, Bot. Mag. **161**: *t. 8607*. 1915; Harms in Sargent, Pl. Wils. **2**: 557. 1916, Mitt. Deutsch. Dendr. Ges. **27**: 9. 1918; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Rehder, Jour. Arn. Arb. **9**: 98. 1928; Lee, For. Bot. China 869. 1935.

Eleutherococcus leucorrhizus Oliv. in Hook. Icon. **18**: *t. 1711*. 1887; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 342. 1888; Nakai, Fl. Sylvat. Koreana **16**: 29. 1927.

A shrub 2–4 m. tall, glabrous throughout, the branches nearly unarmed or with 1–6 prickles at nodes, the leaves commonly 5-foliolate, the umbels terminal, solitary or several together in a corymbose cluster. Prickles slender, reflexed, sharply pointed, the internodes occasionally prickly. Leaves commonly 5-, sometimes 3–4-foliolate, petiolate; petioles 3–7 cm. long, occasionally armed toward tip with 1 or 2 prickles; leaflets chartaceous, short-petiolulate, glabrous, obovate, oblong, lanceolate, or oblanceolate, 5–12 cm. long, 2–4 cm. wide, the apex acuminate, the base cuneate, the margins sharply double-serrate, the lateral nerves about 6–10 on each side, distinct on both surfaces, the tertiary nerves inconspicuous; petiolules 3–6 mm. long. Inflorescence of terminal umbels, solitary or several together in a corymbose cluster, the umbels many-flowered, 4–5 cm. in diameter, the peduncles 4–10 cm. long, glabrous, the pedicels 1–2 cm. long, glabrous. Calyx glabrous, the margin minutely 5-dentate. Petals 5, ovate, acute, 2 mm. long, glabrous, reflexed. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles united into a column. Fruit globose-ovoid, 3–7 mm. long, slightly angular, the style-column persistent, short.

Kansu: Chi-shan, *F. N. Meyer 1769* (NY); Lien-hoa Shan, *J. F. Rock 13665* (AA); Lower Tebbu country, Wantsang, *J. F. Rock 14669* (AA), *14721* (AA, W), *15023* (AA).

Hupeh: No precise locality, *Henry 2573* (W), *2580* (W), *7909* (G, NY); Chang-yang Hsien, *Wilson 1965* (AA, G, W), *1967* in part (AA, G); Patung Hsien, *Wilson 1967* in part (AA, W); western Hupeh, *Wilson 2229* (AA, NY, W); Wan Tsao Shan, *W. Y. Chun 3915* (AA).

Szechuan: Mt. Omei, *Wilson 4936* (AA); *W. P. Fang 2795* (AA), *2861* (AA), *6692* (AA), *6723A* (AA, NY), *6713* (AA, NY, W), *7655* (AA), *7762* (AA), *F. T. Wang 23363* (AA), *Y. S. Liu 1181* (AA), *1190* (AA); O-pien Hsien, *Y. S. Liu 2246* (AA), *2248* (AA).

Yunnan: Litiping Range, Mekong-Yangtze divide, east of Weihsi, *J. F. Rock 11553* (AA, W); Wei-si Hsien, *H. T. Tsai 57912* (AA), *57929* (AA), *57939* (AA), *59587* (AA); no data, *H. T. Tsai 57797* (AA); Wei-si Hsien, Yeh-chih, *C. W. Wang 78076* (AA); northwestern Likiang, Tamichung, *R. C. Ching 21449* (AA).

This species is related to *Acanthopanax Henryi* (Oliv.) Harms and *A. Simonii* Schneider, but may be readily distinguished by its glabrous leaves. It is also closely related to *A. senticosus* (Rupr. & Maxim.) Harms, differing in the stem being unarmed or few-prickled at the nodes only, the glabrous leaflets, the shorter style-column, and the slightly angular fruits.

2a. **Acanthopanax leucorrhizus** var. **fulvescens** Harms & Rehder in Sargent, Pl. Wils. **2**: 558. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 10. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Lee, For. Bot. China 869. 1935.

Eleutherococcus leucorrhizus var. *fulvescens* Nakai, Fl. Sylvat. Koreana **16**: 27. 1927.

Acanthopanax longipes Hand.-Maz. Symb. Sin. **7**: 696. 1933, syn. nov.

Leaves 3–5-foliolate, the leaflets mostly elliptic, large and broad, sharply and closely serrate and often slightly double-serrate, scabrous-pubescent above, fulvous-pubescent on the veins beneath; petiolules densely fulvous-pubescent.

HUPEH: Fang Hsien, *Wilson 288* (paratype, AA, W); Wan Tsao Shan, *W. Y. Chun 3922* (AA).

SZECHUAN and SIKANG: Wen-chuen Hsien, *Wilson 1975* (HOLOTYPE, AA, isotype, W); Tachienlu, *Wilson 1001* (paratype, AA, W), *1023* (paratype, AA, G, W), *3693A* (paratype, AA); Sungpan Ting, *Wilson 4558* (paratype, AA); Li-fan Hsien, *F. T. Wang 21613* (AA); Mao Hsien, *F. T. Wang 21948* (AA); Mt. Omei, *F. T. Wang 23335* (AA), *Y. S. Liu 1616* (AA); Konting, *C. Y. Chiao 1806* (AA).

YUNNAN: Between the Yangtze and the Mekong, *Handel-Mazzetti 7865* (isotype of *Acanthopanax longipes* Hand.-Maz., AA); Liang-shan, I'cho, *H. T. Tsai 51291* (AA); no data, *H. T. Tsai 57366* (AA); Wei-si Hsien, Yeh-chih, *C. W. Wang 68337* (AA).

Acanthopanax longipes Hand.-Maz. is herewith reduced to synonymy after an examination of the isotype. Among the specimens cited above, *Wilson 288* and *4558, Wang 68337, Tsai 51291,* and *Handel-Mazzetti 7865* have the leaves distinctly double-serrate like the variety *scaberulus* Harms & Rehder. However, they lack the bristles on the veins and the petiolules and apparently represent a transition to that variety.

2b. **Acanthopanax leucorrhizus** var. **scaberulus** Harms & Rehder in Sargent, Pl. Wils. **2**: 558. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 10. 1918; Chung, Mem. Sci. Soc. China **1**: 186. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 133. 1929; Lee, For. Bot. China 869. 1935.

Eleutherococcus leucorrhizus var. *scaberulus* Nakai, Fl. Sylvat. Koreana **16**: 29. 1927.

Leaves always 5-foliolate, the leaflets smaller and narrower than in the species, obovate-oblong to oblanceolate, distinctly doubly serrate, the teeth acuminate to setose-acuminate, scabrous above, more or less fulvous-pubescent along the veins beneath, with spreading or slightly reflexed bristles on the petiolules and on the midrib beneath.

KIANGSI: Lushan, *A. N. Steward 4724* (AA, G, W).

HUPEH: Fang Hsien, *Wilson 323* (HOLOTYPE, AA, isotype, W), *323A* (paratype, AA, G, NY, W); Patung Hsien, *Wilson 323B* (paratype, AA); without precise locality, *Henry 5950E* (AA), *5950C* (G, W), *6503B* (AA, G).

SZECHUAN: Washan, *Wilson 1966* (paratype, AA, G, W); Omei Shan, *Y. S. Liu 1164* (AA), *1272* (AA), *W. P. Fang 12870* (AA), *12932* (AA), *C. Y. Chiao & C. S. Fan 273* (AA), *717* (AA), *802* (AA).

SIKANG: Konting, *C. Y. Chiao 2052* (AA).

3. **Acanthopanax setchuenensis** Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; Harms, op cit. **36**: Beibl. **82**: 81. 1905; Harms & Rehder in Sargent, Pl. Wils. **2**: 559. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 10. 1918; Chung, Mem. Sci. Soc. China **1**: 188 1924; Lee, For. Bot. China 870. 1935.

Eleutherococcus setchuenensis Nakai, Fl. Sylvat. Koreana **16**: 30. 1927.

A shrub to 3 m. tall, the branches yellowish, unarmed or with few prickles, the leaves mostly 3-foliolate, the umbels terminal, 3–7 together. Prickles nearly straight, commonly grouped at base of petioles. Leaves 3-foliolate, very rarely 5-foliolate, petiolate; petioles 4–10 cm. long; leaflets coriaceous, petiolulate, dark green above, glaucescent beneath, glabrous, oblong-elliptic to ovate-oblong, 5–12 cm. long, 2–6 cm. wide, the apex acuminate to cuspidate, the base broadly cuneate or nearly rounded, the lateral ones often oblique, the margins remotely and irregularly serrulate or serrate-dentate to nearly entire, the lateral nerves about 8

on each side, subconspicuous above, distinct beneath, the tertiary veins very slightly impressed above, inconspicuous beneath; petiolules 3–8 mm. long. Inflorescence of 3–7 umbels clustered together, terminal, glabrous, the umbels many-flowered, about 3 cm. in diameter, the peduncles 1–3 cm. long, the middle ones sometimes to 10 cm. long, the pedicels 0.6–2 cm. long. Calyx glabrous, the margin 5-dentate. Petals 5, triangular-ovate, 2 mm. long, glabrous, reflexed. Stamens 5, the filaments 2.5 mm. long. Ovary 5-celled, the styles connate into a column. Fruit broadly ellipsoid, 6–8 mm. long, black, the style-column persistent, very short, about 1 cm. long.

SHENSI: Lao-y-shan, *J. Giraldi s. n.* (AA); Tai-pei-shan, *W. Purdom 2* (AA); Lung-chow, Kuan Shan, *J. Hers 2363* (AA).

HUPEH: No precise locality, *Henry 5950B* (AA, G, W), *6521* (G, W), *6630* (G, W); Fang Hsien, *Wilson 620* (AA, G, NY, W); Hsing-shan Hsien, *Wilson 1968* (AA, G, W); Wan Tsao Shan, *W. Y. Chun 3893* (AA); Lung Men Ho, *W. Y. Chun 4020* (AA), *4365* (W).

SZECHUAN and SIKANG: No precise locality, *C. Bock and A. Rosthorn 2573* (syntype, AA); Tachienlu, *Wilson 3693* (AA), *1044* (AA); Muping, *Wilson 865* (AA, W); Wa-chan, *Wilson 1113* (AA, W); Kuan Hsien, *W. P. Fang 2247* (AA, NY); south and east of Miao Hsien, *F. T. Wang 21964* (AA).

KWEICHOW: Lao Shan, Fan Ching Shan, *Steward, Chiao & Cheo 505* (W).

A species closely allied to *Acanthopanax leucorrhizus* Harms and distinguished from it by the almost invariably 3-foliolate leaves, the leaflets being glaucous beneath, more coriaceous, and with more remote and shallow serrations.

4. **Acanthopanax Henryi** (Oliv.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 49. 1894; Harms ex Diels, Bot. Jahrb. **29**: 488. 1900; Harms op. cit. **36**: Beibl. **82**: 80. 1905; Schneider, Ill. Handb. Laubholzk. **2**: 424, *f. 289 h–i, 290b.* 1909; O. Stapf, Bot. Mag. **135**: *t. 8316.* 1910; Sprenger, Mitt. Deutsch. Dendr. Ges. **20**: 240. 1911; Harms & Rehder in Sargent, Pl. Wils. **2**: 557. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 11. 1918; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Lee, For. Bot. China 869. 1935.

Eleutherococcus Henryi Oliv. in Hook. Icon. **18**: *t. 1711.* 1887; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 341. 1888; Hesse, Mitt. Deutsch. Dendr. Ges. **22**: 272. 1913; Nakai, Fl. Sylvat. Koreana **16**: 28. 1927.

A shrub about 1–3 m. tall, the branches rough-pubescent when young, soon becoming glabrous, armed with stout slightly recurved prickles, the leaves mostly 5-foliolate, the umbels several clustered together at the end of lateral branches. Leaves 5-foliolate, rarely 3-foliolate, petiolate; petioles 4–7 cm. long, scabrous; leaflets chartaceous, subsessile to short-petiolulate, deep green and scabrid above, paler and more or less pubescent especially along the nerves beneath, obovate to oblong, 3–10 cm. long, 2–4 cm. wide, the terminal ones often larger, the apex acute or short-acuminate, the base narrowly cuneate, the margins entire or often serrulate toward apex, the lateral nerves about 7 on each side, distinct on both faces, the tertiary veins inconspicuous; petiolules 0–7 mm. long, scabrid. Inflorescence of several umbels clustered together at end of lateral branches, the umbels many-flowered, 1–3 cm. in diameter, the terminal much larger than the others; peduncles stout, glabrous to pubescent, 1–3 cm. long, the pedicels 0.8–1.5 cm. long, glabrous or slightly pubescent. Calyx glabrous or slightly pubescent, the margin subentire. Petals 5, ovate, 2 mm. long, reflexed. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles united into a column. Fruit globose-ellipsoid, 8 mm. long, black, slightly 5-angular, the style-column persistent, slender, 2 mm. long.

SHENSI: Kian-shan, *J. Giraldi s. n.* (AA).

HONAN: Sunghsien, Shih Tse Miao, *J. Hers 1240* (AA).

HOPEI: Po Hua Shan, *T. F. King 520* (NY).

CHEKIANG: No precise locality, *Barchet 197* (W).

HUPEH: No precise locality, *Henry 4832* (G), *7609* (NY, G); Hsing-shan Hsien, *Wilson 379* (AA, W), *1977* (AA); Hsin-tien-tsze, *W. Y. Chun 4038* (AA).

4a. **Acanthopanax Henryi** var. **Faberi** Harms, Mitt. Deutsch. Dendr. Ges. **27:** 12. 1918.

Eleutherococcus sp. Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 342. 1888.

Differs from the typical form in the leaflets being glabrous beneath, the serrations often broad, the umbels small, the pedicels commonly very pubescent, and the calyx often puberulous.

CHEKIANG: Tienmushan, *T, N. Liou 263* (NY).

5. **Acanthopanax Simonii** Schneider, Ill. Handb. Laubholzk. **2:** 426. *f. 290c.* 1909; Dunn, Jour. Linn. Soc. Bot. **39:** 413. 1911; Bean, Trees and Shrubs Brit. Isles **1:** 133. 1914; Harms & Rehder in Sargent, Pl. Wils. **2:** 559. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27:** 12. 1918; Chung, Mem. Sci. Soc. China **1:** 188. 1924; Hand.-Maz. Symb. Sin. **7:** 697. 1933; Lee, For. Bot. China 870. 1935.

Eleutherococcus Simonii Decne. ex Simon-Louis, Preisverzeichnis Herbst 1902 und Frühjahr 1903. 33. 1902, *nomen nudum;* Hesse, Mitt. Deutsch. Dendr. Ges. **22:** 272. *f.* 1913; Goez, op. cit. **25:** 168. 1916; Nakai, Fl. Sylvat. Koreana **16:** 30. 1927.

Eleutherococcus leucorrhizus Hort. ex Gard. Chron. III. **38:** 404. *f. 152.* 1905; non Oliv.

A shrub to 3 m. tall, the branches glabrous and smooth or with several stout slightly curved prickles below the petioles, the leaves 5-foliolate, the umbels 2–5 together at end of branches. Leaves 5-foliolate, seldom 3–4-foliolate, petiolate; petioles 5–7 cm. long, often with slender prickles; leaflets chartaceous, bright green, bristly on both surfaces, subsessile to short-petiolulate, oblong to oblanceolate, 4–12 cm. long, 1.5–4 cm. wide, the middle ones larger, the lateral ones much smaller, the apex acuminate, the base cuneate, the margins sharply and doubly serrate, the lateral nerves about 8–10 on each side, distinct on both surfaces, the tertiary veins inconspicuous; petiolules 2–7 mm. long, prickly or not. Inflorescence of umbels, 2–5 together at end of branches, glabrous, short-pedunculate, the umbels many-flowered, 2–3 cm. in diameter, the peduncles 1–5 cm. long, glabrous, the pedicels slender, glabrous, 4–10 mm. long, the flowers small, green. Calyx glabrous, the margin subentire to minutely 5-dentate. Petals 5, ovate, acute, 1.5 mm. long, glabrous on both surfaces, reflexed. Stamens 5, the filaments 1.5 mm. long. Ovary 5-celled, the styles connate into a short column. Fruit globose-ovoid, 5–6 mm. across, slightly 5-angular, black, the style-column persistent, short, about 1.5 mm. long.

NO PRECISE LOCALITY: *C. Schneider s. n.* (AA).

HUNAN: Yun-schan, *Handel-Mazzetti 835 = 12488* (AA).

HUPEH: Western Hupeh, *Henry 6503* (AA, G), *6503A* (W); western Hupeh, *Wilson 1456* (AA, NY), *2229A* (NY).

YUNNAN: Chen-hsiung Hsien, *H. T. Tsai 52740* (AA).

KWEICHOW: Tuyun, *Y. Tsiang 5746* (NY); Tating, *Y. Tsiang 8878* (NY).

This species is very near *Acanthopanax leucorrhizus* Harms but can be distinguished by the bristly leaves, by the inflorescence which consists of several short-stalked umbels, and by the stout recurved prickles.

6. **Acanthopanax brachypus** Harms, Bot. Jahrb. **36:** Beibl. **82:** 80. 1905; Dunn, Jour. Linn. Soc. Bot. **39:** 413. 1911; Harms, Mitt. Deutsch. Dendr. Ges. **27:** 13. 1918; Chung, Mem. Sci. Soc. China **1:** 187. 1924; Lee, For. Bot. China 868. 1935.

Eleutherococcus brachypus Nakai, Fl. Sylvat. Koreana **16:** 27. 1927.

A shrub with glabrous branches, unarmed or sometimes with a single prickle at the nodes, the leaves 3–5-foliolate, very short-petiolate, the inflorescence in umbels, 1 or 2 terminating the branches. Prickles short, pointing backward. Leaves very short-petiolate; petioles 2–4 mm. or less long; leaflets chartaceous, glabrous, sessile or short-petiolulate, obovate to obovate-oblong, 3–6 cm. long, 1–2.5 cm. wide, the apex rounded or short-acute, the base narrowly attenuate, the margins entire, the lateral nerves about 3–5 on each side, subconspicuous above, elevated and prominent beneath, the tertiary veins slightly impressed above, inconspicuous beneath; petiolules 0–1 cm. long. Flowers unknown. Fruiting inflorescence of umbels, 1 or 2 terminating the branches, glabrous,

the umbels many-fruited, the peduncles 3–6 cm. long, the pedicels 1–1.5 cm. long. Fruit subglobose, 5 mm. long, strongly 5-angular, the styles united into a single column, persistent, about 2 mm. long.

SHENSI: Fukio, *Giraldi 36* (HOLOTYPE, photo. and merotype in AA).

This species is characterized by its very short-petiolate leaves.

7. **Acanthopanax phanerophlebius** Merr. & Chun, Sunyatsenia **2**: 12. *t. 6.* 1934.

An erect to subscandent shrub, the branches unarmed and glabrous, castaneous-pubescent when young, the leaves 3–4-foliolate, the umbels terminal, several loosely arranged together. Leaves petiolate; petioles 10–16 cm. long; leaflets chartaceous, sessile to subsessile, glabrous, oblong-elliptic, 14–17 cm. long, 5.5–8 cm. wide, the apex acuminate, the base of median ones narrowly attenuate, symmetrical, of the lateral ones very unequal, broad, 2-nerved and rounded on the outside, acute on the inside, the margins serrate-dentate, the lateral nerves about 10 on each side, distinct and elevated on both surfaces, the tertiary nerves conspicuous and elevated on both surfaces. Inflorescence of umbels, several loosely arranged together, terminal, about 18 cm. long, castaneous-pubescent when young, the umbels many-flowered, 2.5 cm. in diameter, the peduncles 4–6 cm. long, more or less umbellately arranged on the main axis, the bracts ovate, acuminate, pubescent, about 5 mm. long, the bracteoles lanceolate, acuminate, 3 mm. long, the pedicels about 1 cm. long, slender, ferruginous-pubescent. Calyx pubescent outside, 5-dentate, the lobes oblong, obtuse, 1 mm. long. Petals 5, oblong-ovate, acute, 2.5 cm. long, 1.5 cm. wide, slightly coherent, glabrous to obscurely pubescent toward tips. Ovary 2–4-celled, the disk elevated, hemispherical, the styles united into a single column, 1–1.2 cm. long.

KWANGTUNG: Sunyi, Wokchong Ping, *S. P. Ko 51780* (HOLOTYPE, NY); Sunyi, Falon Shan, *C. Wang 30911* (NY).

A species characterized by being entirely unarmed and by its lax inflorescence, the castaneous indumentum on the young parts and the inflorescences, and its 3–4-foliolate leaves, the leaflets large, more or less sessile, with prominent nerves and very inequilateral outer leaflets. It closely resembles *Brassaiopsis tripteris* (Lévl.) Rehder and is undoubtedly congeneric with that species. As *Brassaiopsis* typically has 2-celled ovaries, it does not seem to be desirable to transfer *Acanthopanax phanerophlebius* to that genus at the present time. When more complete material is available it may, however, be desirable to make some other generic disposition of this apparently distinct form as well as of *Brassaiopsis tripteris*. Unfortunately the material available for study representing *Brassaiopsis tripteris* and *Acanthopanax phanerophlebius* is at present very limited. The fruits of both are as yet unknown.

8. **Acanthopanax divaricatus** (Sieb. & Zucc.) Seem. Jour. Bot. **5**: 239. 1867, Revis. Heder. 87. 1868; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 339. 1888; Harms, in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 50. 1864, Mitt. Deutsch. Dendr. Ges. **27**: 17. 1918; Nakai, Jour. Arn. Arb. **5**: 6. 1924; Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933.

Panax divaricatus Sieb. & Zucc. Abh. Akad. Muench. **4**(2): 200. 1845.

Kalopanax divaricatus Miq. Ann. Mus. Bot. Lugd.-Bat. **1**: 17. 1863, **2**: 158. 1866.

Acanthopanax asperatus Franch. & Sav. Enum. Pl. Jap. **1**: 193. 1875, **2**: 378. 1879; Franch. Pl. David. **1**: 146 (as *A. asperulatum*). 1884.

A shrub about 1–3 m. tall, glabrous or pubescent when young, unarmed or with reflexed prickles, the leaves 5-foliolate, the umbels solitary or more commonly 3–7 together at ends of branches. Leaves 5-foliolate, long-petiolate; petioles 4–7 cm. long; leaflets sessile or short-petiolulate, scattered-pubescent or almost glabrous above, villose-pubescent or scattered-pubescent beneath, scarcely glabrous, obovate-oblong to obovate-lanceolate or oblong-lanceolate, 4–7 cm. long,

2–4 cm. wide, the apex acute to acuminate, the base attenuate, the margins simply or doubly serrate, the lateral nerves about 6–8 on each side, subconspicuous above, distinct beneath, the tertiary veins inconspicuous; petiolules 0–5 mm. long. Inflorescence of umbels, these solitary or more commonly 3–7 together at end of branches, the umbels many-flowered, about 2 cm. in diameter, the peduncles pubescent, 1.5 cm. or more long, the pedicels 4–10 mm. long, pubescent. Calyx pubescent, the margin subentire. Petals 5, glabrous, about 1.5 mm. long. Stamens 5, the filaments about 2 mm. long. Ovary 2-celled, the styles united into a simple column, separated at tip only into 2 stigmas. Fruit globose, 2-celled, about 8 mm. long, the style-column persistent, about 2 mm. long.

HONAN: Northern Honan, Tsi Yuan Hsien, Tien Tai Shan, *J. Hers 184* (AA).
ADDITIONAL DISTRIBUTION: Japan.

This Japanese species is recorded by several authors from North China, as occurring in the provinces Jehol and Hopei, and possibly also in Anhwei and elsewhere. I have seen only one specimen from China that I can refer to this species.

9. **Acanthopanax sessiliflorus** (Rupr. & Maxim.) Seem. Jour. Bot. **5**: 239. 1867, Revis. Heder. 87. 1868; Franch. Pl. David. **1**: 145. 1884; Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 50. 1894; Yabe, Enum. Pl. Manch. 98. 1912; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 14. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Nakai, Jour. Arn. Arb. **5**: 5. 1924, Fl. Sylvat. Koreana **16**: 22. *t. 2.* 1927; Nakai, Honda, Satake, & Kitagawa, Rep. 1st Sci. Exp. Manch. **6**(6): 35. 1936.

Panax sessiliflorus Rupr. & Maxim. Bull. Phys.-Math. Acad. St. Pétersb. **15**: 133. 1857; Regel, Gartenfl. **11**: 238. *t. 369.* 1862.

Cephalopanax sessiliflorum Baill. ex Nakai, Jour. Arn. Arb. **5**: 5. 1924, as synonym.

A shrub 2–5 m. tall, the branches spreading, with few scattered prickles or unarmed, the leaves commonly 3-foliolate, the umbels solitary, compact, subcapitate, 3–5 together at the ends of branches. Prickles stout and straight. Leaves 3-, sometimes 5-foliolate, petiolate; petioles 3–12 cm. long, unarmed or sometimes with a few prickles; leaflets short-petiolulate, chartaceous, nearly glabrous or sometimes scabrid, obovate or oblong-obovate to oblong-lanceolate, the median ones 12–18 cm. long, 5–7 cm. wide, the lateral ones 8–14 cm. long, 3–6 cm. wide, the apex acuminate, the base cuneate, the lateral ones often slightly oblique, the margins irregularly serrate, the lateral nerves about 5–7 on each side, conspicuous, the tertiary nerves inconspicuous on both surfaces; petiolules 0.2–1 cm. long. Inflorescence of compact subcapitate umbels, mostly 3–5 together, arranged in a raceme or in a compound umbel at end of branches, the umbels globose, many-flowered, 3.5 cm. in diameter, the terminal one often larger, the peduncles short, pubescent, 0.5–1 cm. long, the terminal one often longest. Flowers sessile. Calyx densely pubescent, the margin distinctly 5-dentate. Petals 5, dull purplish, 1.5 mm. long. Stamens 5, the filaments 1.5 mm. long. Ovary 2-celled, the styles united into a single column, with 2 distinct stigmas. Fruit black, broadly ellipsoid, 1–1.5 cm. long, slightly angular, arranged in a globose head about 3–4 cm. across.

HOPEI: Hsiao-wu-tai-shan, Yang Kia Ping, *H. Smith 303* (AA); Hsiao-wu-tai-shan, Tien-lin-ssu, *H. Smith 758* (AA); Hsaio-wu-tai-shan, Yang Kia Ping, *J. Hers 2097* (AA); Shih Pa Pan Ling, *Liu & Read L2012 = R563* (AA); Eastern Tomb, *C. F. Li 10098* (NY); Tan-nan-kou, *C. W. Wang 60484* (AA).

MANCHURIA: No precise locality, *E. Faber 1757* (NY); Amur, *Maximowicz s. n.* (G, NY, W), *R. Maack s. n.* (G); coast of Manchuria, *C. Wilford s. n.* (G); Amur River, *V. Komarov 1148* (AA, NY); Liaotung Peninsula, Wangfangko, *D. Litvinov s. n.* (AA, G, NY); Er Tien Tien Tze, *P. H. & J. H. Dorsett 3107* (AA, NY, W); Etrentrentze Station, *Skvortzov s. n.* (AA); Mulin, *Skvortzov s. n.* (AA); Koalingtze Station, *Skvortzov s. n.* (AA); Kirin, Chingpohu, Changcharlingtzu, *H. W. Kung 2087* (NY); Kirin, *F. H. Chen 333* (AA, NY).

ADDITIONAL DISTRIBUTION: Korea.

This species is characterized by the pubescent sessile flowers, compactly arranged in globose subcapitate umbels, and the short-pubescent peduncles.

9a. **Acanthopanax sessiliflorus** var. **parviceps** Rehder, Mitt. Deutsch. Dendr. Ges. **21**: 192. 1912.

A low shrub; leaflets elliptic, 5–9 cm. long, acute, slightly and distinctly serrate; umbels one or few, less than 3 cm. across; fruit ovoid, 1 cm. or less long.

HOPEI: Cultivated in the Arnold Arboretum from seeds sent by E. Bretschneider from Peking in 1881, specimens collected July 20, 1911, Aug. 1, 1911, Aug. 21, 1911, and Oct. 10, 1911, *no. 588–7029* (AA).

10. **Acanthopanax lasiogyne** Harms in Sargent, Pl. Wils. **2**: 563. 1916, Mitt. Deutsch. Dendr. Ges. **27**: 17. *t. 2.* 1918; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Lee, For. Bot. China 869. 1935.

A shrub 2–6 m. tall, the branches glabrous and unarmed(?), the leaves 3-foliolate, the umbels terminal and solitary. Leaves short- or long-petiolate; petioles glabrous, 1.5–6 cm. long; leaflets sessile to subsessile, chartaceous, glabrous, oblong or obovate to obovate-oblong, about 4–6 cm. long, 1.5–4.5 cm. wide, the apex short-acuminate, the base acute, the lateral ones more or less oblique, the margins entire or subentire to slightly serrate near apex, the lateral nerves about 5 or 6 on each side, subconspicuous, the tertiary veins slightly impressed above. Inflorescence a terminal solitary umbel, many-flowered, short-pedunculate, the peduncles 5 mm. long, tomentose to glabrescent, elongated to about 1 cm. in fruit, the pedicels 5–7 mm. long, tomentose, glabrescent in fruit, the bracteoles membranaceous, ovate, 2 mm. long, tomentose. Calyx 1.5 mm. long, densely white-tomentose, the margin subentire. Petals 5, triangular-ovate, 2 mm. long, glabrous on both surfaces, reflexed. Stamens 5, the filaments 2 mm. long. Ovary 2-celled, the styles 2, connate at base. Fruit rounded, much compressed, glabrous, 7–8 mm. long, the styles about 2 mm. long, united to middle, reflexed above.

SIKANG: Near Tachienlu, *Wilson 1313* (HOLOTYPE, AA, isotype, AA, G, NY, W); *Wilson 4167* (paratype, AA); Kangtin Hsien, Tachienlu, *W. P. Fang 3523* (AA).

Harms' original specimens are all unarmed, but *Fang 3523* bears two short, nearly straight prickles with broad, elongate bases. This species resembles *Acanthopanax scssiliflorus* Seem. in its white-tomentose flowers, but is readily distinguished by its longer pedicels. It is very similar to *A. Wardii* Smith in general appearance, but the latter has wholly glabrous flowers and much longer peduncles and pedicels.

11. **Acanthopanax cissifolius** (Griff.) Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 50. 1894; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 19. 1918; Hand.-Maz. Symb. Sin. **7**: 697. 1933; Lee, For. Bot. China 870. 1935.

Aralia cissifolia Griff. ex Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 722. 1879.

Eleutherococcus cissifolius Nakai, Chosen-shokubutsu **1**: 420. 1914, Jour. Arn. Arb. **5**: 9. 1924, Fl. Sylvat. Koreana **16**: 27. 1927.

A shrub about 3 m. tall, the branches unarmed or with scattered short prickles, the leaves mostly 5-foliolate, the umbels terminal and mostly solitary. Leaves mostly 5-, rarely 3–4-foliolate, long-petiolate; petioles 5–12 cm. long, slender, glabrous or pubescent, often with a single prickle; leaflets chartaceous, subsessile to short-petiolulate, glabrous or scattered-pubescent above, pubescent especially along the nerves beneath, lanceolate to oblanceolate or obovate to oblong, about 4–7 cm. long, 1.5–3.5 cm. wide, the apex acuminate, the base attenuate, the margins simply or doubly serrate, the lateral nerves about 6–8 on each side, subconspicuous above, manifest beneath, the tertiary veins inconspicuous above, subconspicuous beneath; petiolules 0.5 mm. long. Inflorescence a solitary ter-

minal umbel, sometimes with one or two additional short-pedunculate umbels at base, the umbels many-flowered, about 2.5 cm. across; peduncles 4–12 cm. long, somewhat pubescent, the pedicels about 0.8–1 cm. long, pubescent. Calyx glabrous, the margin entire. Petals 5, triangular, ovate, glabrous, about 2 mm. long. Stamens 5, the filaments 2 mm. long. Ovary 3–5-celled, the styles 5, more or less wholly distinct. Fruit globose, about 8 mm. across, black.

YUNNAN: No precise locality, *Forrest 10211* (AA); between the Yangtze and Kungsian, *C. Schneider 2387* (AA, G); Tschanalaka, Tseku, *Handel-Mazzetti 8888* (AA); Wei-si Hsien, Yeh-chih, *C. W. Wang 70411* (AA); Chungtien Plateau, *T. T. Yü 13622* (AA).

ADDITIONAL DISTRIBUTION: North India.

This species is characterized by its 3 to 5 almost entirely free styles. Some of the specimens cited above are more or less sterile or fragmentary, but in general they seem to agree well with the Indian specimens. Most of them have the leaves almost wholly glabrous.

12. **Acanthopanax Yui** sp. nov. Fig. 12.

Frutex circa 1 m. altus, ramulis dense vel parce aculeatis, aculeis gracilibus conicis, reflexis, subtus leviter dilatatis. Foliis 3–5-foliolatis petiolatis; petiolis 4–12 cm. longis glabris, inermibus vel parce aculeatis; foliolis submembranaceis, sessilibus vel subsessilibus, supra secus venas parce setulosis vel glabris, subtus

Fig. 12. *Acanthopanax Yui; 1.* branchlet with infructescence, × ½; *2.* flower, × 5; *3.* fruit, × 3.

glabris, obovatis vel oblongis vel obovato-oblongis, 3.5–10 cm. longis, 1.5–4.5 cm. latis, lateralibus plerumque minoribus et obliquis, apice acutis vel breviter acuminatis, basi cuneatis, margine irregulariter duplicato-serratis, nervis lateralibus utrinsecus circa 8–10, supra subconspicuis, subtus prominentibus, venis tertiariis obscuris. Inflorescentiis umbellatis terminalibus solitariis, umbellis multifloris circa 4 cm. latis, pedunculis 1 cm. longis glabris. Calyce glabro 1.5–2 cm. longo, margine integro. Petalis 5 triangulari-ovatis, 2 mm. longis, glabris. Staminibus 5, filamentis 2 mm. longis. Ovario 5-loculari, stylis 5 ad basim connatis. Fructu ovoideo, 7 mm. longo, 6 mm. magno, pentagono.

YUNNAN: No data, *T. T. Yü 9935* (AA), *12165* (TYPE, AA); Atungtze, Mt. Yangtsa, *T. T. Yü 10188* (AA).

This species is related to *Acanthopanax Giraldii* Harms, from which it may be distinguished by its stouter, conical prickles, larger leaflets, and larger umbels. *Yü 9935* is densely armed, while the other two specimens are only sparingly so. Otherwise the several specimens agree and they clearly belong to the same species.

13. **Acanthopanax Giraldii** Harms, Bot. Jahrb. **36:** Beibl. **82:** 80. 1905; Dunn, Jour. Linn. Soc. Bot. **39:** 413. 1911; Harms & Rehder in Sargent, Pl. Wils. **2:** 560. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27:** 19. *t. 3, A–H.* 1918; Chung, Mem. Sci. Soc. China **1:** 187. 1924; Rehder, Jour. Arn. Arb. **9:** 98. 1928; W. W. Smith, Notes Bot. Gard. Edinb. **17:** 65, 132, 319. 1929–30; Lee, For. Bot. China 868. 1935.

Eleutherococcus Giraldii Nakai, Jour. Arn. Arb. **5:** 9. 1924, Fl. Sylvat. Koreana **16:** 28. 1927.

A shrub to 3 m. tall, the branches densely armed with bristle-like spreading or reflexed prickles, the leaves 3–5-foliolate, the umbels terminal and usually solitary. Leaves petiolate; petioles 3–6 cm. long, often bristly; leaflets submembranaceous, sessile to subsessile, glabrous, sometimes sparingly setose when young, obovate to obovate-oblong, 2.5–5 cm. long, 1.5–2.5 cm. wide, the apex acute to short-acuminate, the base narrowly cuneate, the margins irregularly double-serrulate, the lateral nerves about 5 on each side, subconspicuous above, inconspicuous beneath, the tertiary veins obscure. Inflorescence of terminal umbels, these usually solitary, short-pedunculate, glabrous, many-flowered, about 2 cm. in diameter; peduncles commonly 7 mm. long, occasionally to 2 cm. long, the pedicels 5–7 mm. long, glabrous. Calyx glabrous, the margin subentire. Petals 5, ovate, 2 mm. long, glabrous. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles 5, connate below, spreading at tip. Fruit subglobose, 8 mm. across, 5-angular, the style-column persistent, short, divided nearly to middle, spreading above.

KANSU: Gragannar, south of Old Taicho, *R. C. Ching 887* (AA, G, W); Lien-hoa-shan, *J. F. Rock 12695* (AA), *13491* (AA); T'ao River Basin, Shiaoku, beyond Adjuan, *J. R. Rock 12845* (AA, W); T'ao River Basin, Shiaoku, en route to Tsarekika, East Tebbu, *J. F. Rock 13534* (AA, W); lower Tebbu country, upper Mayaku, *J. F. Rock 14764* (AA); Wantsang, *J. F. Rock 14811* (AA, NY); Dayyayaku, Muishan, *J. F. Rock 14866* (AA); Ngongo, *J. F. Rock 14983* (AA); Tschinglung-shan et Matschaling, Lantschou, *G. Fenzel s. n.* (AA).

SHENSI: Tai-pei-shan, *W. Purdom 3* (AA), *445* (AA, W).

HOPEI: Wei-chang, *W. Purdom 7* (AA).

HUPEH: No precise locality, *Henry 6891* (G, W).

SZECHUAN and SIKANG: Tachienlu, *Wilson 1014* (AA, G, W); southeast of Tachienlu, *Wilson 1969* (AA, W); northeast of Tachienlu, *Wilson 1970* (AA, W), *1971* (AA, W); Sungpan-ting, *Wilson 4018* (AA); west of Kuan Hsien, *Wilson 4018A* (AA); Sungpan, *H. Smith 2831* (AA); Dongrego, *H. Smith 3641* (AA); Sungpien Hsien, *W. P. Fang 4145* (AA, NY); Fu-pien Hsien, *F. T. Wang 21414* (AA).

This species is characterized by the densely arranged bristle-like prickles and the 5 styles connate to about the middle and spreading above.

13a. **Acanthopanax Giraldii** var. **inermis** Harms & Rehder in Sargent, Pl. Wils. **2:** 560. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27:** 20. 1918; Chung, Mem. Sci. Soc. China **1:** 187. 1924; Lee, For. Bot. China 868. 1935.

Eleutherococcus Giraldii var. *inermis* Nakai, Fl. Sylvat. Koreana **16:** 28. 1927.

Branches unarmed or nearly so, slightly scabrid.

SHANSI: Yao-shan, Hsaiotszhuan, *L. Licent 12668* (AA).

HUPEH: Fan Hsien, *Wilson 276* (HOLOTYPE, AA, isotype, AA, G, NY, W); Hsiang-shan Hsien, *Wilson 1976* (paratype, AA, W); no precise locality, *Wilson 2354* (NY); Enshih Hsien, *H. C. Chow 1802* (AA, NY).

13b. **Acanthopanax Giraldii** var. **pilosulus** Rehder, Jour. Arn. Arb. **9:** 99. 1928; Lee, For. Bot. China 868. 1935.

Branches nearly unarmed; leaflets lanceolate to oblanceolate, simple-serrate, sparsely scabrid-pilosulose above, short villose-pilose beneath.

KANSU: Hsiao Mo K'ou, near Lichen, *R. C. Ching 337* (AA, W); Tebbu country, *J. F. Rock 13106* (HOLOTYPE, AA); T'ao River Basin, west of Adjuan, eastern Minshan Range, *J. F. Rock 12657* (paratype, AA); from Tibetan Country west, Tow River, *W. Purdom s. n.* (AA); southwest of Tow River, Taochow, *W. Purdom s. n.* (AA).

The two specimens collected by Purdom have the branches more or less densely armed, but their leaflets suggest this variety. Evidently they represent a transition from the typical form to this variety.

14. **Acanthopanax Wilsonii** Harms in Sargent, Pl. Wils. **2:** 560. 1916, Mitt. Deutsch. Dendr. Ges. **27:** 20. 1918; Chung, Mem. Sci. Soc. China **1:** 188. 1924; Hand.-Maz. Symb. Sin. **7:** 697. 1933; Lee, For. Bot. China 871. 1935.

Eleutherococcus Wilsonii Nakai, Jour. Arn. Arb. **5:** 9. 1924, Fl. Sylvat. Koreana **16:** 31. 1927.

A shrub 2–3 m. tall, with glabrous or minutely puberulous branches unarmed or setose-prickly at the nodes, small 3–5-foliolate leaves, and solitary umbels at ends of long or short branches. Leaves long- or short-petiolate; petioles 0.5–6 cm. long, glabrous; leaflets chartaceous, subsessile, glabrous, oblanceolate or lanceolate to oblong-oblanceolate, about 4–5.5 cm. long, 0.5–1.6 cm. wide, the lateral ones often oblique and slightly curved, the apex acute to acuminate, the base narrowly attenuate, the margins crenate-serrulate, the lateral nerves 3–4 on each side, subconspicuous above, inconspicuous beneath, the tertiary veins obscure. Inflorescence of solitary umbels at ends of short or long branches, the umbels many-flowered, about 2.5 cm. across, the peduncles 1.5–5 cm. long, glabrous, the pedicels about 1 cm. long, occasionally with one or two flowers developed at base of peduncle. Calyx glabrous, the margin subentire to minutely 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long, glabrous. Stamens 5, the filaments 2 mm. long. Ovary 3–5-celled, the styles 3–5, connate at base, free above middle. Fruit subglobose, angular, 6–7 mm. in diameter, the styles 5, about 1.5 mm. long, connate at base, free and divergent above.

SZECHUAN and SIKANG: West of Kuan Hsien, *Wilson 1972* (HOLOTYPE, AA, isotype, W); Tachienlu, *Wilson 3690* (paratype, AA); northeast of Sungpan, *Wilson 4561* (paratype, AA).

YUNNAN: No precise locality, *Forrest 10259* (AA); Yuling-schan, Likiang, *Handel-Mazzetti 6645* (AA, W); Yangtze watershed, District of Likiang, western slopes of Likiang Snow Range, *J. F. Rock 3771* (AA, NY, W), *4866* (AA, W); Yangtze drainage basin east of Likiang, *J. F. Rock 8984* (W); Chungtien, *J. F. Rock 24712* (AA, NY, W); northern flank of Haba Snow Range, *K. M. Feng 1330* (AA); Lai-cha-tse-ka, southeast of Chungtien, *K. M. Feng 1860* (AA).

This species is closely related to *Acanthopanax Sieboldianus* Makino, and can be distinguished from the latter by the terminal inflorescence, the styles being connate only at base, and the narrower leaflets. The Yunnan specimens cited

above have generally larger leaflets, shorter peduncles, and mostly unarmed branches; otherwise they seem to agree well with the type from Szechuan.

15. **Acanthopanax stenophyllus** Harms in Sargent, Pl. Wils. **2**: 564. 1916, Mitt. Deutsch. Dendr. Ges. **27**: 20. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Lee, For. Bot. China 870. 1935.

Eleutherococcus stenophyllus Nakai, Jour. Arn. Arb. **5**: 9. 1924; Fl. Sylvat. Koreana **16**: 31. 1927.

A shrub about 2–3 m. tall, with subglabrous to glabrous branches unarmed or slightly bristle-prickly at the nodes, 3–5-foliolate leaves, and terminal solitary umbels. Leaves long-petiolate; petioles 3–7 cm. long, glabrous; leaflets narrow, chartaceous, glabrous, subsessile to short-petiolulate, lanceolate or oblanceolate to oblong-oblanceolate, 2–6.5 cm. long, 0.4–1.5 cm. wide, the apex acuminate (acumen often slightly curved), the base narrowly attenuate, the margins simply or doubly serrate, the lateral nerves 6–10 on each side, subconspicuous above, inconspicuous beneath, the tertiary veins obscure. Inflorescence of terminal solitary umbels, these many-flowered, about 3 cm. across, the peduncles short, about 1 cm. or less long, glabrous, elongating in fruit, the pedicels slender, about 1 cm. long, glabrous. Calyx glabrous, minutely 5-dentate. Petals 5, triangular-ovate, 1.2 cm. long, glabrous. Ovary 3–5-celled, the styles 3–5, shortly connate at base, free above, about 0.8 mm. long. Fruit subglobose, slightly 5-angular, 7 mm. long, the styles 3–5, united at base only, distinct above.

SHENSI: Tai-pei-shan, *W. Purdom 4* (ISOTYPE, AA, W).
SZECHUAN: Li-fan Hsien, *F. T. Wang 21644* (AA).

This species is characterized by its narrow leaflets and the 3–5 styles connate at base only.

15a. **Acanthopanax stenophyllus** f. **angustissimus** Rehder, Jour. Arn. Arb. **9**: 99. 1928.

Differs from the species in the leaflets being more linear, only 3–5 mm. wide, and minutely serrulate. A shrub 0.75–2.5 m. tall; branches armed at the nodes with a few bristle-like erect prickles.

KANSU: Lower Tebbu country, Wantsang, *J. F. Rock 14850* (HOLOTYPE, AA).

15b. **Acanthopanax stenophyllus** f. **dilatatus** Rehder, Jour. Arn. Arb. **13**: 338. 1932; Lee, For. Bot. China 870. 1935.

Differs from the species in the mostly 3-foliolate leaves; leaflets oblong-oblanceolate to oblong-obovate, 6–11 cm. long, 2–3.5 cm. wide. Branches unarmed.

SHANSI: Yuan-ch'u District, Shiu-wang-ping, *H. Smith 6563* (HOLOTYPE, AA).

16. **Acanthopanax setulosus** Franch. Nouv. Arch. Mus. Paris. II. **8**: 249. 1886, Pl. David. **2**: 67. 1888; Harms ex Diels, Bot. Jahrb. **29**: 489. 1900; Viguier, Ann. Sci. Nat. IX. Bot. **4**: 41. 1906; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 25. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Lee, For. Bot. China 870. 1935.

A scandent shrub 3–5 m. tall, the branches densely bristly, with a reflexed prickle at base of petioles, the leaves 5-foliolate, the umbels axillary and solitary. Leaves long-petiolate, the petioles glabrous; leaflets small, chartaceous, sessile, scattered-setose along the veins above, glabrous beneath, ovate-oblong to obovate-oblong, about 2 cm. long and 0.8 cm. wide, the terminal one slightly larger, the apex acute to short-acuminate, the base attenuate, the margins sharply serrate toward the upper half, the lateral nerves about 3 or 4 on each side, inconspicuous, the tertiary veins obscure. Inflorescence of solitary axillary umbels, sometimes with 1 or 2 flowers developed at base of peduncle, the umbels many-flowered, about 2.5 cm. in diameter, the peduncles 2 cm. long, densely long-bristly, the pedicels slender, glabrous, 0.5–1 cm. long. Calyx glabrous, minutely 5-dentate. Petals 5, ovate-oblong, glabrous, 2 mm. long, reflexed. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles 5, short, united below.

SZECHUAN: Moupine, *O. David s. n.* (MEROTYPE, in AA).

This species is close to *Acanthopanax Sieboldianus* Makino, differing in the bristly stems and peduncles. Franchet describes the plant as near to *A. spinosus* (Linn. f.) Miq. He does not mention the number of cells in the ovary. In the type collection the ovary is found to be 5-celled and the number of styles to be 5; thus the plant proves to be quite different from *A. spinosus.* I agree with Viguier, who has noticed the 5-celled ovary and placed it near *A. Sieboldianus,* instead of with Harms, who followed Franchet and placed it near *A. spinosus.*

17. **Acanthopanax Rehderianus** Harms in Sargent, Pl. Wils. **2:** 561. 1916, Mitt. Deutsch. Dendr. Ges. **27:** 20. 1918; Chung, Mem. Sci. Soc. China **1:** 188. 1924; Lee, For. Bot. China 869. 1935.

Eleutherococcus Rehderianus Nakai, Jour. Arn. Arb. **5:** 9. 1924, Fl. Sylvat. Koreana **16:** 30. 1927.

A scandent shrub about 3 m. tall, the branches minutely brownish-puberulous when young, armed with scattered reflexed prickles, the leaves mostly 5-foliolate, the umbels solitary at end of short branches. Prickles usually solitary at base of petioles. Leaves 5- rarely 3- or 4-foliolate, chartaceous, glabrous, shining above, pale beneath, the leaflets subsessile, obovate-oblong to oblanceolate, 2–6 cm. long, 0.8–2 cm. wide, the apex acute to short-acuminate, the base gradually attenuate, the margins crenate-serrate toward apex, the lateral nerves about 5 on each side, conspicuous above, inconspicuous beneath, the tertiary veins obscure. Inflorescence of solitary umbels at the ends of short branches, the umbels glabrous, many-flowered, about 2.5 cm. in diameter, the peduncles 1–2 cm. long, glabrous, the pedicels slender, about 1 cm. long, sometimes with 1 or 2 flowers developed at base of peduncles. Calyx glabrous, the margin subentire. Petals 5, triangular-ovate, 1.5 mm. long, glabrous, reflexed. Ovary 4- or 5-celled, the styles 4 or 5, connate into a short conical column, the stigmas distinct at apex, recurved. Fruit subglobose, slightly angular, about 5 mm. long, the style-column short, about 0.8 mm. long.

HUPEH: No precise locality, *Henry 5930* (G, W); no precise locality, *Wilson 1020* (paratype, AA); south Wushan, *Wilson 1974* (HOLOTYPE, AA, isotype, W).

This species is closely related to *Acanthopanax Wilsonii* Harms, from which it may be distinguished by the stouter and solitary prickles, the broader leaflets with more crenate serrations, the generally shorter peduncles, and the connate styles.

18. **Acanthopanax Sieboldianus** Makino, Bot. Mag. Tokyo **12:** 10. 1898; Rehder, Jour. Arn. Arb. **7:** 243. 1926; Rehder & Wils. op. cit. **8:** 180. 1927; Chien, Contr. Biol. Lab. Sci. Soc. China **3:** 68. 1927.

Acanthopanax spinosus Miq. Ann. Mus. Bot. Lugd.-Bat. **1:** 10. 1863; non *Panax spinosus* Linn. f.

Acanthopanax pentaphyllus Marchal, Bull. Soc. Bot. Belg. **20:** 79. 1881; Chung, Mem. Sci. Soc. China **1:** 188. 1924; non *Aralia pentaphylla* Thunb.

Eleutherococcus pentaphyllus Nakai, Chosen-shokubutsu **1:** 420. 1914, Fl. Sylvat. Koreana **16:** 29. 1927.

Eleutherococcus japonicus Nakai, Jour. Arn. Arb. **5:** 10. 1924, excl. syn. *Acanthopanax japonicus.*

A shrub to 2 m. tall, with slender arching branches unarmed or with a few compressed prickles, 5–7-foliolate leaves, and solitary umbels borne on short lateral branches. Leaves petiolate, partly fascicled on short spurs; petioles glabrous, 3–10 cm. long; leaflets submembranaceous to chartaceous, glabrous, subsessile, obovate to oblong-obovate, 2–3.5 cm. long, 1.5–2 cm. wide, the apex acute, the base cuneate, the margins crenate-serrate, the lateral nerves about 4–6 on each side, subconspicuous, the tertiary nerves inconspicuous on both surfaces.

Inflorescence of glabrous solitary umbels borne on lateral branches, the umbels 2–2.5 cm. in diameter, the peduncles slender, 5–10 cm. long, the flowers dioecious, greenish white, the pedicels 1 cm. long, glabrous. Calyx glabrous, minutely 5-dentate. Petals 5, ovate, 2 mm. long, glabrous. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles 5, connate nearly to apex. Fruit black, subglobose, 6–8 mm. across.

ANHWEI: Wang Shan, *N. P. Ip UN4783* (AA); Wang Shan, *W. C. Cheng 4146* (W); Chien Shan Hsien, Tien Chu Shan, *C. S. Fan and Y. Y. Li 171* (AA).

ADDITIONAL DISTRIBUTION: Japan.

This species is near *Acanthopanax gracilistylus* W. W. Smith, differing in the glabrous leaves, longer peduncles, and the five styles connate nearly to apex.

19. **Acanthopanax gracilistylus** W. W. Smith, Notes Bot. Gard. Edinb. **10:** 6. 1917, **14:** 85. 1924; Nakai, Jour. Arn. Arb. **5:** 4. 1924; Hand.-Maz. Symb. Sin. **7:** 697. 1933; Merr. Lingnan Sci. Jour. **13:** 41. 1934; Lee, For. Bot. China 868. 1935.

Acanthopanax spinosus sensu Hance, Jour. Bot. **18:** 261. 1880; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 341. 1888; Harms ex Diels, Bot. Jahrb. **29:** 489. 1900; Dunn & Tutch. Kew. Bull. Add. Ser. **10:** 119. 1912; Harms & Rehder in Sargent, Pl. Wils. **2:** 562. 1916, pro parte; Harms, Mitt. Deutsch. Dendr. Ges. **27:** 23. 1918, pro parte; Chung, Mem. Sci. Soc. China **1:** 188. 1924; Smith, Notes Bot. Gard. Edinb. **17:** 17, 23. 1929; Courtois, Notes Bot. Chine Mus. Heude **2:** 55. 1933; Lee, For. Bot. China 870. 1935; non Miq.

Acanthopanax Hondae Matsuda, Bot. Mag. Tokyo **31:** 333. 1917; Nakai, Jour. Arn. Arb. **5:** 3. 1924; Rehder, Jour. Arn. Arb. **8:** 180. 1927; Chun, Sunyatsenia **2:** 1. 1934; Cheng ex Pei, Contr. Biol. Lab. Sci. Soc. China **10:** 37. 1935; Lee, For. Bot. China 868. 1935.

Acanthopanax spinosus f. *inerme* Matsuda, Bot. Mag. Tokyo **26:** 281. 1912, syn. nov.

Acanthopanax Hondae var. *inerme* Nakai, Jour. Arn. Arb. **5:** 4. 1924, syn. nov.

Acanthopanax Hondae var. *armatum* Nakai, Jour. Arn. Arb. **5:** 4. 1924; Lee, For. Bot. China 869. 1935, syn. nov.

A scandent shrub 2–3 m. tall, with glabrous spreading branches unarmed or with few reflexed prickles, 5-foliolate leaves, and solitary umbels axillary or at end of very short branches. Prickles if present usually single at base of petioles. Leaves 5-, rarely 3- or 4-foliolate, long-petiolate; petioles 5–8 cm. long; leaflets submembranaceous to chartaceous, subsessile, glabrous, sometimes slightly setose along veins on both surfaces, obovate to oblanceolate, 3–6 cm. long, 1–2.5 cm. wide, the apex acute to short-acuminate, the base cuneate, the margins crenate-serrulate toward apex, the lateral nerves 4 or 5 on each side, subconspicuous, ferruginous-tomentose in axils beneath, the tertiary veins obscure. Inflorescence of solitary umbels, axillary or at end of very short branches, occasionally 2 together, the umbels many-flowered, 2 cm. in diameter, the peduncles 1–2 cm. long, glabrous, elongating in fruit, the pedicels slender, glabrous, 6–10 mm. long. Calyx subentire to minutely 5-dentate. Petals 5, ovate-oblong, acute, 2 mm. long. Stamens 5, the filaments as long as the petals. Ovary 2-celled, the styles 2, slender, distinct, about 2 mm. long. Fruit subglobose, about 6 mm. long, 5 mm. wide, laterally compressed, black, 2-seeded, the styles 2, 2 mm. long, divergent.

SHENSI: Yenan Fu, *W. Purdom 350* (AA, G, W).

HONAN: Lushih, Huing Eul Shan, *J. Hers 41* (AA); Teng Feng Hsien, Yu Tai Shan, *J. Hers 290* (AA); Sunghsien, Shih Tze Miao, *J. Hers 1241* (AA).

KIANGSU: Siao Hsien, Huang Tsang Yu, *J. Hers 1052* (AA); Kiangyin, *A. Allison 181* (G); Bau Hwa Shan, *A. N. Steward 2116* (AA, G, W); Pao Hwa Shan, Chuying, *Tso 355* (AA); Hai Nei, south of Ishing, *Ching & Tso 491* (AA); Pao Hwa Shan, *Chun 2113* (AA); Ishing, *K. Ling UN12295* (G), *UN12553* (G); southern Nanking, Tung Sheng Chiao, *Y. L. Keng 1604* (AA); south of Ishing, Kufu town, *Y. L. Keng 2691* (AA).

CHEKIANG: Ningpo, *D. Macgregor s. n.* (AA); Hangchow, *F. N. Meyer 1473* (AA); Taichow, *R. C. Ching 1300* (AA, G, W); Tientai Shan, *R. C. Ching 1393* (AA, W); Siachu,

R. C. Ching 1791 (AA, LU, W); Mei Ki, *R. C. Ching 4914* (AA); Tientai Shan, *C. Y. Chiao UN14381* (AA, W); Ningpo, *Y. L. Keng 1118* (AA).

ANHWEI: Chiu Hwa Shan, *R. C. Ching 2650* (AA), *2705* (AA, LU); Wang Si-chi, south Chiu Hwa Shan, *R. C. Ching 2864* (AA); Chien Shan Hsien, Tien Chu Shan, *C. S. Fan & Y. Y. Li 203* (AA).

KIANGSI: Dunghwa-schan, inter Schitscheng et Ninghwa, *Wang-Te-Hui 332* (AA); Hongsan, *J. L. Gressitt 1498* (AA).

HUNAN: Lantien, Hsinhwa, *Handel-Mazzetti 594 = 11742* (AA); Changming Hsien, Yang-shan, *C. S. Fan & Y. Y. Li 213* (AA).

HUPEH: No precise locality, *Henry 3406A* (AA, G); Ichang, *Henry 3406* (AA, G, W); no precise locality, *Wilson 1119* (NY), *1224* (G); Changlo Hsien, *Wilson 1973* (AA, G, W); Wan Tsao Shan, *W. Y. Chun 3921* (AA).

YUNNAN: Mengtze, *Henry 10639* (AA, NY); Za Kou, *E. E. Maire 450* (AA), *7463* (NY); Chungtien plateau, *Forrest 13779* (AA); Sung-Kwei, *Forrest 13854* (AA); mountains in the northeast of the Yangtze bank, *Forrest 10411* (AA); Litiping, Yangtze-Mekong Divide, *Forrest 19419* (AA, W); Litiping Range, Mekong-Yangtze divide, east of Weihsi, *J. F. Rock 9407* (AA, NY, W); Wei-si Hsien, *C. W. Wang 63693* (AA); northwestern Likiang, Chi-tien, *R. C. Ching 20481* (AA).

KWEICHOW: Kweiting, *Y. Tsiang 5489* (NY); Tunghaushan, Ihwang, *Y. Tsiang 1004* (NY); Tsungyi Hsien, Liang Fen Yah, *Steward, Chiao & Cheo 258* (AA, NY, W); Da-po-son, Tsingchen, *S. W. Teng 90353* (AA).

KWANGTUNG: Yingtak, Tai Chuen, *H. Y. Liang 60946* (AA); Sungyi, Youk Chong Ping, *C. Wang 32263* (AA); Tsengshing District, Naam Kwan Shan, *W. T. Tsang 20083* (AA, NY), *20199* (AA, LU, NY), *20393* (AA, NY); Lung-men District, Naam Kuan Shan, Sheung Ping Village, *W. T. Tsang 25375* (AA).

This Chinese species is now considered by most authors to be distinct from the Japanese *A. spinosus* Miq. I agree with Handel-Mazzetti that *A. gracilistylus* and *A. Hondae* Makino are synonymous. This species resembles *A. Sieboldianus* Makino in general appearance, but is readily distinguished from the latter by its two slender and free styles. The species is of very wide distribution in China. Variations in leaf-sizes are frequent. The branches vary from armed to unarmed. It is very difficult to differentiate these as separate forms, as quite frequently only one or several scattered prickles may be found on a specimen. It is hard to ascertain that a plant is totally unarmed if it is represented by merely a twig in the herbarium. This character alone certainly does not warrant considering the proposal of varieties based on the presence or absence of prickles. I have placed such specimens under the typical form.

Acanthopanax nodiflorus Dunn and *A. villosulus* Harms are identical with *A. gracilistylus* in all characters except the indumentum on the leaves. It seems desirable to reduce them to varieties of the latter.

19a. **Acanthopanax gracilistylus** var. **pubescens** (Pampanini) comb. nov.

Acanthopanax spinosus var. *pubescens* Pampanini, Nuov. Giorn. Bot. Ital. II. **17**: 678. 1910; Lee, For. Bot. China 870. 1935.

Leaflets glabrous above, pubescent especially along the nerves beneath.

HUPEH: *Silvestri 1598, 1600* (SYNTYPES of *Acanthopanax spinosus* Miq. var. *pubescens* Pampanini, photos in AA, NY); no precise locality, *Wilson 1030* (NY); Tung-chien Hsien, *H. C. Cheo UN18247* (NY).

19b. **Acanthopanax gracilistylus** var. **villosulus** (Harms) comb. nov.

Acanthopanax villosulus Harms in Sargent, Pl. Wils. **2**: 562. 1916, Mitt. Deutsch. Dendr. Ges. **27**: 25. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Lee, For. Bot. China 871. 1935.

Acanthopanax spinosus Pavolini, Nuov. Giorn. Bot. Ital. II. **15**: 418. 1908; non Miq.

Leaflets glabrous to slightly setulose above, villose and slightly setulose along the nerves beneath.

HUPEH: Payung Hsien, *Wilson 379A* (HOLOTYPE of *Acanthopanax villosulus* Harms, AA, isotypes, G, W); Chienshi Hsien, *Wilson 957* (paratype, NY).

SZECHUAN: *Henry 5890* (G, W), cultivated.

19c. **Acanthopanax gracilistylus** var. **nodiflorus** (Dunn) comb. nov.

Acanthopanax nodiflorus Dunn, Jour. Bot. **47**: 199. 1909, Jour. Linn. Soc. Bot. **39**: 413. 1911; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 119. 1912; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 24. 1918; Chung, Mem. Sci. Soc. China **1**: 187. 1924.

Leaflets scabrid-setulose above, scabrid to pubescent beneath.

KWANGTUNG: Yangshan District, Yang Shan, *T. M. Tsui 531* (AA, W), *751* (AA); Yu-yuen, *S. P. Ko 52789* (AA).

KWANGSI: Sui-luk District, mountains surrounding Pa Lan Village, *W. T. Tsang 21930* (AA).

20. **Acanthopanax trifoliatus** (Linn.) Merr. Philip. Jour. Sci. **1**: Suppl. 217. 1906; Schneider, Ill. Handb. Laubholzk. **2**: 427. 1909; Rehder in Bailey, Stand. Cycl. Hort. **1**: 193. 1914; Harms & Rehder in Sargent, Pl. Wils. **2**: 563. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 26. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Nakai, Jour. Arn. Arb. **5**: 1. 1924; Merr. Lingnan Sci. Jour. **5**: 140. 1927; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 172, *272*. 1929–30; McClure, Lingnan Univ. Sci. Bull. **3**: 31. 1931; Hand.-Maz. Symb. Sin. **7**: 698. 1933, Beih. Bot. Centralbl. **52B**: 172. 1934; Lee, For. Bot. China 871. 1935; Merr. Trans. Am. Ph. Soc. II. **24**(2): 291. 1935, Jour. Arn. Arb. **18**: 71. 1937.

Zanthoxylum trifoliatum Linn. Sp. Pl. 270. 1753.

Panax aculeatus Ait. Hort. Kew ed. 1. **3**: 448. 1789; DC. Prodr. **4**: 252. 1830; G. Don, Gen. Syst. **3**: 384. 1834.

Plectronia chinensis Lour. Fl. Cochinch. 162. 1790, ed. Willd. 201. 1793.

Panax Loureiranus DC. Prodr. **4**: 252. 1830.

Aralia trifoliata Meyen, Reise **2**: 332. 1835, *nomen nudum;* Walp. Nova Acta Acad. Nat. Cur. 14. Suppl. **1**: 348. 1843; K. Koch, Wochenschr. Gärtn. Pflanzenk. **2**: 366. 1859.

Acanthopanax aculeatus H. Witte, Annal. Hort. Bot. Pays-Bas **4**: 89. 1861; Seem. Jour. Bot. **5**: 238. 1867, Revis. Heder. 86. 1868; Hance, Jour. Linn. Soc. Bot. **13**: 105. 1867; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 726. 1879; Franch. Pl. David. **1**: 146. 1884; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 339. 1888; Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 50. 1894; Harms ex Diels, Bot. Jahrb. **29**: 489. 1900; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 119. 1912; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1166. 1923; Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933.

Acanthopanax sepium Seem. Jour. Bot. **5**: 239. 1867, Revis. Heder. 86. 1868.

A scandent shrub or climber, about 2–7 m. tall, with scattered prickles on the branches and petioles, the leaves commonly 3-foliolate, the umbels 3–10 together in terminal racemes or compound umbels. Prickles short, sharp-pointed, recurved at tips, broadened and elongated at base, usually present at base of petioles, single or in pairs. Leaves commonly 3-foliolate, rarely 1–5-foliolate, long- or short-petiolate; petioles glabrous, slightly prickly or not, 2–6 cm. long; leaflets chartaceous, short-petiolulate, glabrous on both surfaces, sometimes very slightly setose along the midrib and veins above, elliptic-ovate to elliptic-oblong, 4–8 cm. long, 2.5–4.5 cm. wide, the apex acuminate, the base cuneate, the lateral ones sometimes slightly oblique, the margins generally serrulate, the lateral nerves about 5–7 on each side, conspicuous on both surfaces, the tertiary veins inconspicuous; petiolules 2–8 mm. long, the median ones longer, the lateral ones sometimes subsessile. Inflorescence of umbels, about 3–10 together in terminal racemes or compound umbels, rarely solitary, the umbels few- to many-flowered, the peduncles glabrous, 2–7 cm. long, the pedicels slender, glabrous, about 1 cm. long. Calyx glabrous, 1.5 mm. long, slightly 5-dentate. Petals 5, triangular, 2 mm. long, glabrous on both surfaces, reflexed. Stamens 5, the filaments 3 mm. long. Ovary mostly 2-celled, the styles 2, connate to middle. Fruit rounded, laterally compressed, 3–4 mm. long, the style-column 1.5 mm. long, bifid to middle.

CHEKIANG: Kai-hwa Hsien, *H. H. Hu 508* (AA); Chiangshan, Kwangyintang, *R. C. Ching 2590* (AA, LU).

KIANGSI: Kiennan District, Soi Hang Cheung, near Tung Lei Village, *S. K. Lau 4218* (AA, W); Lungnan District, Oo Chi Shan, near Lam Uk Tung Village, *S. K. Lau 4593* (AA, W).

HUNAN: Hsinhwa, Hsikwangshan, *Handel-Mazzetti 796* (AA); Sinning Hsien, Maling-tung, *C. S. Fan & Y. Y. Li 591* (AA).

HUPEH: Ichang, *Henry 2253* (AA, G), *2253A* (W), *2702* (G); Nan-to, *Henry 2639* (G, NY); no precise locality, *Wilson 842* (NY), *1613* (NY); Ichang, *Wilson 399* (AA, G, W), *399A* (AA); Po Moh Ring, *R. C. Ching 3537* (AA); Chienshih Hsien, *H. C. Chow 1549* (NY), *1698* (AA, NY).

SZECHUAN: No precise locality, *E. Faber 39 = 265* (NY); inter Mosoying et Huili, *Handel-Mazzetti 5639* (AA); Chung Hsien, *W. P. Fang 487* (AA); Mt. Omei, *W. P. Fang 3392* (AA, NY); Omei Hsien, *W. P. Fang 3847* (AA); Lu Hsien, *W. P. Fang 9772* (AA); Kuan Hsien, *S. S. Chien 5760* (AA); O-pien Hsien, *Y. S. Liu 2033* (AA).

SIKANG: Ya-an, *C. Y. Chiao 1162* (AA).

YUNNAN: No precise locality, *Forrest 11713* (AA), *11748* (AA); Shweli-Salwin divide, *Forrest 16046* (AA), *17554* (AA); Szemao, *Henry 12561* (AA, W); no precise locality, *E. E. Maire 2918* (NY, W); Sing-Schouan, *E. E. Maire 2988* (NY); Tali, *C. Schneider 2793* (AA, G, W); between Kambaiti and Tengyueh, via Kuyung, *J. F. Rock 7570* (AA, W); west of Mekong, en route from Pingpo to Youngchang and Tengyueh, Salween watershed, *J. F. Rock 6969* (AA, W); Che-tse-lo, *H. T. Tsai 58512A* (AA); Shang-pa, *H. T. Tsai 58923* (AA), *58926* (AA); Meng-bang, Jenn-yeh Hsien, *C. W. Wang 80318* (AA); Mienning, Wenpishan, *T. T. Yü 17766* (AA), *17767* (AA).

KWEICHOW: Tienfang, *Handel-Mazzetti 297* (AA); Pachai, *Y. Tsiang 6123* (NY); Kweiyang, *Y. Tsiang 8496* (NY); Liang Feng Yoh, *Steward, Chiao & Cheo 126* (AA); Kiangkou Hsien, Miao Wang, *Steward, Chiao & Cheo 566* (AA, W); Tsi-shou, Chengfeng, *S. W. Teng 90787* (AA).

KWANGSI: Lan Lo, east of Lin Yen, *R. C. Ching 6644* (AA); Yeo Mar Shan, north of Hin Yen, *R. C. Ching 7115* (LU, NY); Bako Shan, west of Poseh, *R. C. Ching 7439* (AA, NY, W).

KWANGTUNG: Canton, Honam Island, *Merrill 10057* (NY), *C. Levine CCC182* (AA), *CCC558* (AA), *CCC1235* (W); Nan Shung, *W. Y. Chun 5714* (AA); between Wu Tung and Chang Kiang, *W. Y. Chun 775* (AA); Lantau Island, Kai Yih Shan, *McClure LU13085*, and Tai Ue Shan, *W. T. Tsang 16532*, two collections on same sheet and label (AA, W); Yun-fou District, Chiao-tuo-ying, *C. Wang 577* (AA); Loting, Sanhaiting, *Y. Tsiang 1130* (AA); Lochong, Jui-feng, *Y. Tsiang 1231* (AA); Canton, Peiyungshan, *Y. Tsiang 1606* (AA); Lofoushan, *Y. Tsiang 1686* (AA); Canton, Whampoa, *Y. Tsiang 3344* (NY); Canton, Lung Yen Tung, *W. Y. Chun 7639* (AA, NY); Wung Yuen District, *S. K. Lau 638* (AA, NY); Wung Yuen District, Wang Chuk I, Tsing Wan Shan, *S. K. Lau 2050* (AA); Loh Chang District, Mu Shan, Tai Hang, *W. T. Tsang 20837* (AA, NY); Hweiyang District, Ling Fa Shan, Sam Hang Shek T'an Village, *W. T. Tsang 25860* (AA).

HAINAN: Hoichow, *F. A. McClure CCC7544* (AA, LU).

FUKIEN: Diongloh Hsien, Meihwa, *H. H. Chung 2002* (AA); Foochow, Wooshihshan, *H. H. Chung 2417* (AA); Amoy, *H. H. Chung 4555* (AA); Kushan, *H. H. Chung 7625* (AA, LU); Foochow University and vicinity, *Tang Siu Ging 5560* (LU); Kushan Monastery, *Tang Siu Ging 5820* (AA, LU); Foochow, Hung Sang Gio, *Tang Siu Ging 7088* (AA).

ADDITIONAL DISTRIBUTION: From the eastern Himalayan region to Japan and southward to Indo-China and to Luzon in the Philippine Islands.

A species widely distributed in China. The leaves are variable in size, shape, and serrations. The type of *Zanthoxylum trifoliatum* Linn., the basis of the species, was a specimen collected in the vicinity of Canton, China.

20a. **Acanthopanax trifoliatus** var. **setosus** var. nov.

A typo differt foliolis supra ad costam nervosque plus minusve dense setosis, margine dupliciter setoso-serratis, inflorescentiis plerumque pauciumbellatis.

YUNNAN: Mengtze, *Henry 10158* (NY), *10158A* (NY), *11158* (AA); Szemao, *Henry 12770* (AA, NY, W); Ping-pien Hsien, *H. T. Tsai 61908* (AA).

KWEICHOW: Chenfeng, *Y. Tsiang 4770* (NY).

KWANGSI: Shih Wan Tai Shan, *H. Y. Liang 69974* (TYPE, AA), Aug. 5, 1937; Hing-on District, Wah Kong, *Z. S. Chung 83677* (AA).

KWANGTUNG: Yang-shan District, Yang Shan, south of Linchow, *T. M. Tsui 697* (AA, NY, W).

Among the specimens cited above under the typical form of the species, a number have the leaflets slightly setose. However, these leaflets are simple-serrate instead of double- and setose-serrate. They apparently represent transitions between the species and this variety. The variety *setosus* may later be found to be worthy of specific rank.

21. **Acanthopanax Wardii** W. W. Smith, Notes Bot. Gard. Edinb. **10**: 7. 1917, **17**: 101. 1929.

Acanthopanax ternatus Rehder, Jour. Arn. Arb. **2**: 124. 1920; Chung, Mem. Sci. Soc. China **1**: 188. 1924; Hand.-Maz. Symb. Sin. **7**: 698. 1933; Lee, For. Bot. China 871. 1935, syn. nov.

A shrub 1–3 m. tall, the glabrous branches unarmed or bearing a few scattered prickles with 3-foliolate leaves, and terminal umbels commonly 4–7 arranged together. Leaves petiolate; petioles 2–4 cm. long; leaflets chartaceous, sessile to subsessile, glabrous, green above, pale beneath, ovate or oblong-ovate to obovate, 2–5 cm. long, 1–3 cm. wide, the apex acute, the base broad-cuneate, the margins coarsely 1–7-dentate to entire, the lateral nerves about 5 or 6 on each side, the nerves and tertiary veins slightly impressed above, inconspicuous beneath. Inflorescence of umbels, terminal, commonly 4–7 arranged together, occasionally solitary, the umbels many-flowered, the peduncles 1–2 cm. long, glabrous, with a tuft of tomentum at tip where the pedicels are inserted, the pedicels 5–10 mm. long, slender, glabrous. Calyx glabrous, 1 mm. long, the margin minutely dentate. Petals 5, triangular-ovate, acute, 2 mm. long, glabrous on both surfaces. Stamens 5, the filaments 1.75 mm. long. Ovary 2-celled, the styles 2, erect, 0.5 mm. long, connate at base. Fruit suborbicular, much compressed, 6–7 mm. in diameter, 3 mm. thick, 2-seeded, the style-column about 1.5 cm. long, bifid and reflexed at tip.

SZECHUAN: Drogochi, *H. Smith 4536* (AA); Hsu-tsing, *H. Smith 4753* (AA).

SIKANG: Mekong, Tsa-wa-rung, *C. W. Wang 65469* (AA), *66193* (AA).

YUNNAN: Mountains near Tsin-kou, on the Mekong River, Abbé Monbeig in 1905, plant grown from seed sent by Maurice L. de Vilmorin to the Arnold Arboretum, 1911, *4280* (AA); also specimens from this plant collected in the Arnold Arboretum Oct. 13, 1917, Oct. 14 and 26, 1918 and Oct. 13, 1919 (AA); Mekong, inter vicos Lota-Tanschan et Tsedjrong, *Handel-Mazzetti 7973* (AA); mountains above Tseku and Tsechung, Mekong-Salween watershed, *J. F. Rock 10365* (AA, NY, W); Atungtze, Huann-fu-ping, *C. W. Wang 69179* (AA), *69180* (AA); Atungtze, Hungpoh, *T. T. Yü 7980* (AA), *7986* (AA).

This species closely simulates *Acanthopanax lasiogyne* Harms in appearance. It may be distinguished from the latter especially by its glabrous calyx and pedicels and the greater length of pedicels. It is also related to *A. trifoliatus* (Linn.) Merr., from which it may be distinguished by the more or less straight prickles, unarmed petioles, the shorter peduncles and pedicels, and the more compressed fruits.

22. **Acanthopanax evodiaefolius** Franch. Jour. de Bot. **10**: 306. 1896, Pl. Sin. Ecl. Prim. 26. 1879; Harms ex Diels, Bot. Jahrb. **29**: 489. 1900; Lévl. Cat. Pl. Yun-Nan 11. 1915; Harms & Rehder in Sargent, Pl. Wils. **2**: 563. 1916; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 29. *t. 4, fig. a–c.* 1918; Chung, Mem. Sci. Soc. China **1**: 187. 1924; Rehder, Jour. Arn. Arb. **8**: 181. 1927; Chien, Contr. Biol. Lab. Sci. Soc. China **3**: 68. 1927; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 101, 115, 125. 1929; Hand.-Maz. Symb. Sin. **7**: 698. 1933; Lee, For. Bot. China 865. 1935.

Evodiopanax evodiaefolius Nakai, Jour. Arn. Arb. **5**: 8. 1924.

A shrub or tree, 3–12 m. tall, glabrous, unarmed, with 3-foliolate leaves and terminal umbels, the umbels solitary or few together forming an umbellate panicle.

Leaves usually clustered at ends of long or short branches, petiolate; petioles terete, glabrous, 5–10 cm. long, with a tuft of ferruginous tomentum at tip where the leaflets are attached; leaflets chartaceous to coriaceous, uneven, the lateral ones sessile, oblong-ovate to ovate-lanceolate, the median ones very short-petiolulate or subsessile, ovate to oblong-lanceolate, the base attenuate, the apex more or less long-acuminate, the margin subentire to serrulate, 8–10 cm. long, 2.5–3 cm. wide, the lateral nerves about 6–8 on each side, distinct on both surfaces, with a tuft of tomentum in axils beneath, the tertiary veins conspicuous on both surfaces. Inflorescence of terminal umbels, commonly solitary or few together forming an umbellate panicle, glabrous, the umbels few- to many-flowered, the peduncles slender, glabrous, 2–8 cm. long, the pedicels glabrous, about 1 cm. long, elongating in fruit. Calyx glabrous, 1 mm. long, the margin entire. Petals 5, oblong, acute, 2 mm. long, reflexed, glabrous on both surfaces. Stamens 5, the filaments 2 mm. long. Ovary 2–4-celled, the disk more or less flattened. Styles 2–4, united below, distinct above the middle. Fruit globose, 3–4 mm. across, slightly 2–4-angled, the pedicels 1–2.5 cm. long, the style-column 2 mm. long, 2–4-fid above the middle.

Shensi: Taipei Shan, *G. Fenzel 715* (AA).

Chekiang: No precise locality, *Chekiang Univ. LU77287* (LU); Tien-tai Shan, *R. C. Ching 1488* (AA, W, LU), *1534* (AA, W); Chien-yuan, *R. C. Ching 2315* (AA, G, NY, W); Tien-moo Shan, *R. C. Ching 4996* (AA); Chien-yuang, *Y. L. Keng 353* (AA); Tien-tai Shan, *Y. L. Keng 1063* (AA); west Tien-mu, *H. H. Hu 1646* (AA); Tien-mu Shan, *T. N. Liou 183* (NY).

Anhwei: Tien-tai, Chu-hwa Shan, *R. C. Ching 2814* (NY); Chang-zou Shan, west of Wu Yuan, *R. C. Ching 3218* (AA, LU); Chiu-hwa Shan, *S. C. Sun 1466* (AA, NY).

Kiangsi: Kuling, *L. H. Bailey s. n.* (AA); *C. Y. Chiao UN18629* (NY, W); Lushan, *H. H. Chung & S. C. Sun 528* (AA), *H. H. Hu 2365* (LU).

Hupeh: Western Hupeh, *Wilson 1142* (NY, W); western Hupeh, Hsin-tien-tsze, *W. Y. Chun 4060* (AA).

Szechuan: Wen-chuan Hsien, Wa-ssu Country, *Wilson 4204* (AA, W); Muli, mountains of Kulu, *J. F. Rock 18051* (AA, W); Siga Shan, *J. F. Rock 23869* (AA, NY), *24394* AA, NY); O-Pien Hsien, *Y. S. Liu 2194* (AA).

Southeastern Tibet: Mt. Kenyichunpo and region of Champutong, Salween-Irrawadi watershed, *J. F. Rock 11651* (AA, W); no precise locality, *F. K. Ward 10068* (AA); Solo-la, *J. F. Rock 22652* (AA).

Yunnan: Lichiang, *Forrest 5616* (W); no precise locality, *Forrest 6887* (AA), *10235* (AA); Lichiang, *C. Schneider 2471* (AA), *3288* (AA, G); Kouty, *Simeon Ten 468* (AA), *508* (AA, W); Yangtze watershed, western slopes of Likiang Snow Range, *J. F. Rock 4133* (AA, NY, W); between Likiang, Youngming and Youngpei, *J. F. Rock 5106* (AA, W), *5192* (AA, W); Lotueshan, mountains of Labako, west of the Yangtze bend at Shiku, *J. F. Rock 9512* (AA, NY, W); mountains above Tseku and Tsehchung, Mekong-Salween watershed, *J. F. Rock 10363* (AA, W); Lao-chun Shan, southwest of Shiku and the Yangtze, *J. F. Rock 25404* (AA); Liang Shan, Lami, *H. T. Tsai 51246* (AA); Shang-pa Hsien, *H. T. Tsai 54453* (AA), *56505* (AA); no data, *H. T. Tsai 57212* (AA); Pi-lo Shan, Che-tse-lo, *H. T. Tsai 58091* (AA); Wei-si Hsien, *H. T. Tsai 57841* (AA), *59693* (AA), *59759* (AA), *59841* (AA), *59932* (AA), *59960* (AA); Wei-si Hsien *C. W. Wang 63907* (AA); Chi-na-tung, Cham-pu-tung, *C. W. Wang 66714* (AA); Shi-gi-tung, Champutung, *C. W. Wang 67424* (AA); Champutung, Bar-ru-lah, Salween-Chiuchiang Divide, *C. W. Wang 67550* (AA); Wei-si Hsien, *C. W. Wang 67716* (AA); Atungze, Dokerla, *T. T. Yü 7852* (AA); Atungze, Mt. Kaakerpu, *T. T. Yü 8426* (AA), *10488* (AA); Atungze, Mt. Miyetzimu, *T. T. Yü 10588* (AA); Shunning, Hila, Wumulung, *T. T. Yü 16661* (AA); Chenkang Snow Range, Hsiaoshuishan, *T. T. Yü 17207* (AA); Kuikiang Valley, Taron, Chiengen, *T. T. Yü 19445* (AA); Salwin-Kiukiang Divide, Lung-guailaka, *T. T. Yü 20258* (AA); northern flank of Haba Snow Range, *K. M. Feng 1098* (AA); northwest of Likiang, *R. C. Ching 20524* (AA); northwest Likiang, Tamichung, *R. C. Ching 20510* (AA); Litiping, between Likiang and Weihsi, *R. C. Ching 22091* (AA).

Kweichow: Fan Ching Shan, Lao Shan, *Steward, Chiao & Cheo 478* (AA, NY, W).

Kwangsi: No data, *C. Wang 39573* (AA); Tsu Yeun District, *Z. S. Chung 83561* (AA).

This distinct species is easily recognized by being unarmed, its 3-foliolate leaves, the tuft of tomentum at the insertion of the leaflets to the petiole, and the tomentum in the axils of lateral veins on the lower surface of the leaflets. The leaflets are very variable in size and sometimes also in shape. The pedicels are also variable in length, especially in fruit.

22a. **Acanthopanax evodiaefolius** var. **gracilis** W. W. Smith, Notes Bot. Gard. Edinb. **10:** 6. 1917; Chung, Mem. Sci. Soc. China **1:** 189. 1924; Hand.-Maz. Symb. Sin. **7:** 698. 1933; Lee, For. Bot. China 866. 1935; Hand.-Maz. Oesterr. Bot. Zeitschr. **88:** 304. 1939.

Leaflets 3–5, mostly 5, ferruginous-tomentose in the axils of lateral nerves beneath; umbels few-flowered, the peduncles slender, the pedicels in fruit 1–3.5 cm. long.

Szechuan: Molien, *C. Schneider 1427* (AA).

Yunnan: Lichiang Range, *Forrest 11282* (isotype, AA); no data, *T. T. Yü 11766* (AA).

Kwangsi: Shang-sze District, Shap Mam Taai Shan, near Hoh Lung Village, *W. T. Tsang 22632* (AA); Liow Shiang, Tseungyuen, *C. Wang 39609* (AA); Yao Shan, *C. Wang 40233* (AA); Tsu Yuen District, *Z. S. Chung 83310* (AA), *83451* (AA).

22b. **Acanthopanax evodiaefolius** var. **ferrugineus** W. W. Smith, Notes Bot. Gard. Edinb. **10:** 6. 1917, **14:** 111. 1924, **17:** 166. 1930; Chung, Mem. Sci. Soc. China **1:** 187. 1924; Hand.-Maz. Symb. Sin. **7:** 698. 1933; Lee, For. Bot. China 866. 1935.

Evodiopanax evodiaefolius var. *ferrugineus* Nakai, Jour. Arn. Arb. **5:** 8. 1924.

Leaflets ferruginous-tomentose on lateral nerves beneath; peduncles and pedicels ferruginous-tomentose.

Southeastern Tibet: Tsarung, Solo-la, *J. F. Rock 22283* (AA, NY, W).

Yunnan: Shweli-Salween Divide, *Forrest 12068* (isotype, AA), *15922* (AA); no precise locality, *T. T. Yü 8581* (AA); Shunning, Snow Range, *T. T. Yü 15980* (AA).

Doubtful and Excluded Species

1. **Eleutherococcus melanocarpa** Lévl. Bull. Acad. Géogr. Bot. **24:** 282. 1914, Cat. Pl. Yun-Nan 11. 1915. = *Aralia sp.* (See Harms, Mitt. Deutsch. Dendr. Ges. **27:** 34. 1918).

2. **Eleutherococcus Bodinieri** Lévl. Bull. Acad. Géogr. Bot. **24:** 144. 1914, Fl. Kouy-Tchéou 33. 1914. = *Schefflera sp.* (See Rehder, Jour. Arn. Arb. **15:** 115. 1934).

3. **Acanthopanax Esquirolii** Lévl. Bull. Acad. Géogr. Bot. **24:** 143. 1914, Fl. Kouy-Tchéou 33. 1914. = *Schefflera sp.* (See Rehder, Jour. Arn. Arb. **15:** 114. 1934).

4. **Acanthopanax sp.**

Eleutherococcus Koreanus Nakai, Fl. Sylvat. Koreana **16:** 32. *t.* 7. 1927; Nakai, Honda, Satake, & Kitagawa, Rep. 1st. Sci. Exp. Manch. **6**(6): 35. 1936; non *Acanthopanax Koreanus* Nakai.

This species was first described by Nakai from Korea and later recorded by him as also found in Jehol. His description and illustration suggest *Acanthopanax senticosus* (Rupr. & Maxim.) Harms, and I suspect that the two are identical. However, in the absence of authentic specimens, I leave it as *Acanthopanax sp.*

XIII. Kalopanax Miquel

Kalopanax Miq. Ann. Mus. Bot. Lugd.-Bat. **1:** 10. 1863.

Shrub or tree, the branches stout, armed with short, broad-based prickles. Leaves palmately lobed, serrulate. Flowers perfect, in umbels, the umbels racemosely arranged in large, terminal, compound panicles; pedicels not articulate under the flower. Calyx-margin minutely 5-dentate. Petals 5, valvate. Ovary 2-celled, the styles united into a column. Fruit subglobose, 2-seeded; seeds flat; endosperm uniform.

One species in eastern Asia.

Key to Species and Varieties

A. Leaves shallowly lobed, the lobes ovate.
B. Leaves about 9–25 cm. across, sparsely pubescent beneath .....1. *K. pictus*.
BB. Leaves about 20–40 cm. across, densely pubescent beneath.
1a. *K. pictus* var. *magnificus*.
AA. Leaves deeply lobed, the lobes oblong-lanceolate .....1b. *K. pictus* var. *Maximowiczii*.

1. **Kalopanax pictus** (Thunb.) Nakai, Fl. Sylvat. Koreana **16**: 34. *t. 8, 9, 10*. 1927.

Acer pictum Thunb. Nova Acta Reg. Soc. Sci. Upsal. **4**: 36, 40. 1783.

Acer septemlobum Thunb. Fl. Jap. 161. 1784.

Aralia palmata Lour. Fl. Cochinch. 187. 1790, ed. Willd. 233. 1793; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 338. 1888.

Panax ricinifolius Sieb. & Zucc. Abh. Akad. Muench. **4**(2): 199. 1845 (Fl. Jap. Fam. Nat. **1**: 91).

Brassaiopsis ricinifolia Seem. Jour. Bot. **2**: 291. 1864, Revis. Heder. 18. 1868.

Tetrapanax ricinifolius K. Koch, Wochenschr. Gärtn. Pflanzenk. **2**: 371. 1859.

Acanthopanax ricinifolius Seem. Jour. Bot. **6**: 140. 1868, Revis. Heder. 86. 1868; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 340. 1888; Harms, Mitt. Deutsch. Dendr. Ges. **27**: *t. 5, f. A–D*. 1918; Chung, Mem. Sci. Soc. China **1**: 188. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 379. 1930; Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933; Lee, For. Bot. China 866. 1935.

Kalopanax ricinifolius Miq. Ann. Mus. Bot. Lugd.-Bat. **1**: 16. 1863; Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 51. 1894; Harms ex Diels, Bot. Jahrb. **29**: 489. 1900; Yabe, Enum. Pl. Manch. 98. 1912; Harms & Rehder in Sargent, Pl. Wils. **2**: 564. 1916; Nakai, Jour. Arn. Arb. **5**: 11. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 93, 180, 234. 1929–30; Merr. Lingnan Sci. Jour. **7**: 318. 1931.

Acanthopanax septemlobus Koidz. Bot. Mag. Tokyo **34**: 306. 1925; Hand.-Maz. Symb. Sin. **7**: 699. 1933; Merr. Trans. Am. Phil. Soc. II. **24**(2): 292. 1935; Cheng ex Pei, Contr. Biol. Lab. Sci. Soc. China **10**: 37. 1935.

Kalopanax ricinifolius var. *typicus* Nakai, Jour. Arn. Arb. **5**: 12. 1924.

Kalopanax ricinifolius var. *chinensis* Nakai, Jour. Arn. Arb. **5**: 13. 1921, syn. nov.

Kalopanax pictus var. *typicus* Nakai, Fl. Sylvat. Koreana **16**: 35. 1927.

A sparingly branched tree to 30 m. tall, with palmately 5–7-lobed serrulate leaves, and flowers in umbels, with slender pedicels and peduncles, racemosely arranged in the inflorescence. Branches with stout, short, broad-based prickles. Leaves chartaceous, long-petiolate, suborbicular, 9–25, sometimes to 35 cm. across, with broadly triangular-ovate to oblong-ovate acuminate lobes, the margins serrulate, dark green above and glabrous or nearly so, light green beneath and usually sparsely pubescent when young, the lateral nerves subconspicuous above, projecting beneath; petioles 8–50 cm. long. Inflorescence a large compound terminal panicle 20–30 cm. across, the flowers 5-merous, perfect, in racemosely arranged umbels on branches of panicle, the umbels many-flowered, about 1.5 cm. in diameter, the peduncles slender, 2–3.5 cm. long, the pedicels slender, 5 mm. long, slightly pubescent. Calyx glabrous, the margin minutely 5-dentate. Petals triangular-ovate, 2 mm. long. Stamens 5, the filaments very slender, 5 mm. long. Ovary 2-celled, the disk convex, the styles united into a single column, the stigmas 2, slightly capitate. Fruit subglobose, 4 mm. across, bluish-black, the style-column persistent, slender, 2 mm. long, bifid at tip.

Honan: Tsi-yuan Hsien, Tien Tai Shan, *J. Hers 1779* (AA).

Hopei: Eastern Tomb, *C. F. Li 10046* (NY).

Manchuria: No precise locality, *Maximowicz s. n.* (G, NY, W).

Shangtung: Chefoo, *N. H. Cowdry 560* (AA); Tsingtao, First Park, *C. Y. Chiao 2568* (AA, NY, W); Lao Shan, Pai Chin Shui, *C. Y. Chiao 2752* (AA, NY); Lao Shan, Hwa Yin Sze, *C. Y. Chiao 2783* (AA, NY, W).

Kiangsu: Bow-hwa Shan, *W. Y. Chun 4256* (AA); Tan Yang, Mao Shan, *Tso 1805* (AA); Nanking, *C. Y. Chiao UN14709* (AA); Nanking, Kihshan, *Y. L. Keng 1956* (AA); Nanking, Spirit Valley, *C. Y. Chiao UN18931* (NY, W).

CHEKIANG: No precise locality, *Barchet 194* (W), *K. K. Tson 4044* (NY); Ningpo Mountains, *Faber 44* (AA); Tien Tai Shan, Huating, *C. Y. Chiao UN14477* (W); Tien Tai Shan, *C. Y. Chiao UN14707* (W), *Y. L. Keng 1067* (AA).

ANHWEI: En route Chung Mei Hoh-Tai Hoh Hau, *F. A. McClure 3996 = LU15346* (LU).

KIANGSI: Kiukiang, *G. Shearer s. n.* (G).

HUNAN: Vicum Tungdjiapai prope minas Hsikwangschan distr. Hsinhwa, *Handel-Mazzetti 811 = 2629* (AA); Shinning Hsien, Ma-lin-tung, *C. S. Fan & Y. Y. Li 604* (AA).

HUPEH: Ichang, *Henry 2246* (G), *2246A* (W), *3101* (G); no precise locality, *Henry 4573* (G, NY); western Hupeh, *Wilson 1680* (NY); Tien-scian Hsien, *Silvestri 1601* (AA); Hsing-shan Hsien, *Wilson 602* (AA, W); Ichang, *Wilson 1963* (AA, G, NY, W); Hsu Tien Tsze, *W. Y. Chun UN4389* (W); Chien-shih Hsien, *H. C. Chow 1713* (AA, NY).

SZECHUAN: District of Tschen-keou-tin, *R. P. Farges s. n.* (AA, NY, W); Wa-shan, *Wilson 1962* (AA, W); An Hsien, *W. P. Fang 5551* (AA); Tien-chuan Hsien, *W. P. Fang 3406* (AA); Lo-shan Hsien, *F. T. Wang 23635* (AA); Kuan Hsien, *Y. S. Liu 1916* (AA).

SIKANG: Near Shaw-kwan, *C. Y. Chiao 2039* (AA).

SOUTHEASTERN TIBET: Tsarong, *Forrest 19051* (AA); Mt. Kenyichunpo and region of Champutong, Salween-Irrawadi watershed, *J. F. Rock 11521* (AA, W).

YUNNAN: Mengtze, *Henry s. n.* (W); Likiang, *Handel-Mazzetti 6840* (AA); Mekong, *Handel-Mazzetti 10015* (AA); Yunnanfu, *O. Schoh 67 = 408* (AA); no precise locality, *Forrest 11256* (AA), *11505* (AA); Yunning, *Forrest 16906* (AA); Tseh Chong, banks of the Mekong, *J. F. Rock 11614* (AA, NY, W); Salween Valley, Peng-ta, *T. T. Yü 23103* (AA); south Chungtien, Chiao-tow on the Yangtze, *K. M. Feng 3089* (AA).

KWEICHOW: Huangtsauba-Taipingai, *Handel-Mazzetti 112 = 10346* (AA); Chengfeng, *Y. Tsiang 4206* (AA, NY, W).

KWANGTUNG: Ying Tak, Chung Tung, Tai Taan, *W. T. Tsang & K. C. Wong 3135 = LU14996* (LU); Lokchong Hsien, way to Tai-lang, near Heo-tse-ling, *Y. Tsiang 1347* (AA).

ADDITIONAL DISTRIBUTION: East Siberia, Korea, and Japan.

This species is very variable in leaf-form; the following two varieties are distinct and well marked.

1a. **Kalopanax pictus** var. **magnificus** (Zabel) Nakai, Fl. Sylvat. Koreana **16**: 36. 1927.

Kalopanax ricinifolius var. *magnificus* Zabel, Gartenwelt **11**: 535. 1907; Koehne, Mitt. Deutsch. Dendr. Ges. **22**: 150. 1913; Harms, op. cit. **27**: 32. *t. 5, f. g–o, t. 86.* 1918; Nakai, Jour. Arn. Arb. **5**: 12. 1924.

Acanthopanax acerifolius Schelle, Mitt. Deutsch. Dendr. Ges. **17**: 212. 1908.

Kalopanax septemlobus var. *magnificus* Hand.-Maz. Symb. Sin. **7**: 699. 1933.

Acanthopanax septemlobus var. *magnificus* Cheng, Contr. Biol. Lab. Sci. Soc. China **9**: 204. 1934.

Branches nearly unarmed or with few prickles. Leaves shallowly lobed and densely pubescent beneath, the lobes ovate.

CHEKIANG: Changhua, *F. N. Meyer 1556* (AA).

HUPEH: Hsin Tien-tsze, *W. Y. Chun 4044* (AA).

ADDITIONAL DISTRIBUTION: Japan.

1b. **Kalopanax pictus** var. **Maximowiczii** (V. Houtte) Hara, Bot. Mag. Tokyo **50**: 565. 1936.

Aralia Maximowiczii V. Houtte, Fl. des Serr. **20**: 39. *t. 2067–2068.* 1874.

Acanthopanax ricinifolius var. *Maximowiczii* Schneider, Ill. Handb. Laubholzk. **2**: 429. *f. 291d.* 1909; Harms, Mitt. Deutsch. Dendr. Ges. **27**: 31. *t. 5–7.* 1918; Lee, For. Bot. China 867. 1935.

Kalopanax ricinifolius var. *Maximowiczii* Nakai, Jour. Arn. Arb. **5**: 13. 1924.

Kalopanax septemlobus var. *Maximowiczii* Hand.-Maz. Symb. Sin. **7**: 699. 1933.

Acanthopanax septemlobus var. *Maximowiczii* Cheng, Contr. Biol. Lab. Sci. Soc. China **9**: 204. 1934.

Leaves deeply 5–7-lobed to beyond the middle, the lobes oblong-lanceolate, densely pubescent beneath.

HONAN: No precise locality, *J. Hers 29* (AA); Teng Feng Hsien, Yu-tai Shan, *J. Hers 2709* (AA).
SHANTUNG: Fei Hsien, Meng Shan, *T. Y. Cheo & L. Yen 322* (AA).
KIANGSU: Shanghai, planted on the ground of St. John's Univ., *L. H. Bailey s. n.* (AA); Haichow, Liu Lin Shan, *J. Hers 658* (AA).
CHEKIANG: Tien Tai, *H. H. Hu 253* (AA).
ADDITIONAL DISTRIBUTION: Japan.

XIV. HETEROPANAX Seemann

Heteropanax Seem. Fl. Vit. 114. 1865, Jour. Bot. **4**: 297. 1866, Revis. Heder. 73. 1868.

Small unarmed trees or shrubs. Leaves pinnately compound or decompound, very large, glabrous or nearly so, the leaflets entire; stipules not prominent. Flowers in umbels, the umbels in large panicles, more or less stellate-pubescent, later glabrescent; bracts small, ovate, obtuse, persistent; pedicels not articulate under the flower. Flowers polygamous, the terminal umbels of each panicle-branch mostly perfect-flowered and usually alone fruiting, the lateral mostly staminate. Calyx-margin nearly entire. Petals 5, valvate. Stamens 5, the anthers round-oval. Ovary 2-celled. Styles 2, distinct from base, spreading. Fruit strongly laterally compressed, almost twice as broad as long, 2-seeded; seeds compressed; endosperm ruminated.

About three species in the western Himalaya region, Burma, southern China and Java.

Type species: *Heteropanax fragrans* (Roxb.) Seem. (*Panax fragrans* Roxb.).

KEY TO SPECIES AND VARIETIES

A. Leaflets large, 8–12 cm. long, 3–6 cm. wide; fruit slightly compressed.
B. Leaflets elliptic, short-acuminate, the base cuneate .....1. *H. fragrans.*
BB. Leaflets ovate, short-acuminate, the base rounded to slightly cordate.
1a. *H. fragrans* var. *subcordatus.*
BBB. Leaflets elliptic, long-acuminate, the base narrowly cuneate.
1b. *H. fragrans* var. *attenuatus.*
AA. Leaflets small, less than 8.5 cm. long and 3.5 cm. wide; fruit greatly compressed.
B. Leaflets 4.5–8.5 cm. long, 2–3.5 cm. wide; pedicels in fruit 4 mm. long.
2. *H. brevipedicellatus.*
BB. Leaflets 2.5–6 cm. long, 0.8–2 cm. wide; pedicels in fruit 1 cm. long.
3. *H. chinensis.*

1. **Heteropanax fragrans** (Roxb.) Seem. Fl. Vit. 114. 1865, Jour. Bot. **4**: 297. 1866, Revis. Heder. 73. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 734. 1879; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 343. 1888; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 120. 1912; Lévl. Cat. Pl. Yun-Nan 11. 1915; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1171. 1923; Chung, Mem. Sci. Soc. China **1**: 186. 1924; Merr. & Chun, Sunyatsenia **2**: 295. 1935.

Panax fragrans Roxb. Hort. Bengal. 21. 1814, *nomen nudum,* Fl. Ind. ed. 2. **2**: 76. 1832; DC. Prodr. **4**: 254. 1830.

Hedera fragrans D. Don, Prodr. Fl. Nepal. 187. 1825.

A tree 8–20 m. high, with pinnately decompound leaves, the leaflets elliptic, short-acuminate, cuneate, and with flowers in umbels, racemosely arranged in a panicle. Leaves large, 0.5–1 m. across, stipulate, petiolate, glabrous or nearly so; stipules small, inconspicuous; petioles 15–30 cm. long; leaflets opposite at nodes of rachis and partial rachises, chartaceous, glabrous on both surfaces, elliptic, about 6–12 cm. long, 3–6 cm. wide, the apex short-acuminate, the base cuneate, the margins entire, the lateral nerves 6–10 on both sides, slightly prominent; petiolules 0–1 cm. long. Inflorescence a panicle, about 30–40 cm. long, ferruginous-stellate-tomentose, the rachis soon glabrous; flowers in racemosely arranged umbels on the branches, the branches 10–20 cm. long, the bracts small,

ovate, obtuse, 2–3 mm. long, persistent, the umbels many-flowered, densely subcapitate, 1.2 cm. in diameter, the peduncles 1–1.5 cm. long, the pedicels 2 mm. long or less in flower, elongating in fruit. Calyx tomentose, 2 mm. long, the margin subentire or very inconspicuously 5-dentate. Petals 5, ovate, 2 mm. long, slightly tomentose outside. Stamens 5, the filaments 3 mm. long. Ovary 2-celled, the styles 2, distinct from base, spreading. Fruit laterally compressed, about 7 mm. across, 3–5 mm. thick, glabrous or glaucous, the pedicels 8 mm. long, the styles 2 mm. long; seeds 2, compressed.

YUNNAN: No precise locality, *Henry s. n.* (NY); Muang Pan, *J. F. Rock 2356* (AA, W); Lung-hok, Jenn-yeh Hsien, *C. W. Wang 80187* (AA).

KWANGTUNG: Hongkong, *C. Ford s. n.* (NY); Hongkong, Botanical Garden, *C. S. Sargent s. n.* (AA); Kochow, *To Kang-peng CCC2739* (NY, W); Canton, Bureau of Forestry Garden, *Y. Tsiang 2056* (AA, NY); Poon Ue District, Honan, *Fung Hom Z22 = LU18627* (NY).

HAINAN: Yaichow, *N. K. Chun & C. L. Tso 44635* (AA, NY, W); Chang-kiang District, Look Mooi Shan & vicinity, *S. K. Lau 1241* (AA, NY); Chang-kiang District, Ka Chik Shan and vicinity, *S. K. Lau 2980* (AA); Kan-en District, Chim Fung Ling, near Sam Mo Watt Village, *S. K. Lau 3419* (AA); no precise locality, *H. Y. Liang 63429* (W), *63650* (AA, NY), *66310* (AA, NY, W), *63839* (AA, NY), *66429* (NY), *C. Wang 36212* (AA, NY).

ADDITIONAL DISTRIBUTION: India, Burma, Java.

This is var. *typica* of C. B. Clarke (Hook. f. Fl. Brit. Ind. **2**: 735. 1879). The other two varieties are also found in China.

1a. **Heteropanax fragrans** var. **subcordatus** C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 735. 1879.

Leaflets ovate, about 10 cm. long and 6 cm. wide, short-acuminate, the base rounded or sometimes slightly cordate.

HAINAN: Kan-en District, Chim Fung Mt. near Shan Mo Kwat Village, *S. K. Lau 4876* (AA).

ADDITIONAL DISTRIBUTION: India.

1b. **Heteropanax fragrans** var. **attenuatus** C. B. Clarke in Hook f. Fl. Brit. Ind. **2**: 735. 1879.

Leaflets elliptic, about 11 cm. long, 4.5 cm. wide, long-acuminate, the base narrowly cuneate.

YUNNAN: Near Keng Hung, *J. F. Rock 2556* (AA).

HAINAN: Ching Mai District, Pak Shek Ling and vicinity, *C. I. Lei 284* (AA, NY, W).

ADDITIONAL DISTRIBUTION: India.

2. **Heteropanax brevipedicellatus** sp. nov.

Frutex erectus 4–7 m. altus. Ramis novellis conferte ferrugineo-tomentosis. Foliis pinnatim decompositis, circa 75 cm. latis, foliolis chartaceis, utrinque glabris, supra haud vel vix nitentibus, ellipticis, circa 4.5–8.4 cm. longis, 2–3.5 cm. latis, apice acuminatis, basi arcte attenuatis, margine integris subrevolutis, nervis lateralibus utrinsecus 6, supra inconspicuis, subtus paulo prominentibus; petiolulis nullis vel 1 cm. longis. Inflorescentiis paniculatis 40 cm. vel ultra longis, conferte ferrugineo-tomentosis, floribus novellis capitatim in umbellis dispositis, umbellis racemose secus paniculae ramulos dispositis, 11 cm. vel ultra longis, bracteis 5 mm. longis. Floribus evolutis ignotis. Fructu luteo lateraliter compresso, 1 cm. longo, 2 mm. crasso, stylis 2 conspicuis patentibus 2–3 mm. longis, pedicellis 4 mm. longis.

KIANGSI: Lungnan District, Oo Chi Shan, near Lam Uk Tung Village, *S. K. Lau 4404* (AA, W).

KWANGTUNG: Wung-yeun District, Tsing Wan Shan, Wong Chuk I and vicinity, *S. K. Lau 2426* (AA); Sin-fung District, Sha Lo Shan, Wa Mei Tong Village, *Y. W. Taam 188* (AA); Sin-fung District, Ngong Tin Lo Shan, Lo Tam Village, *Y. W. Taam 306* (TYPE, AA), Jan. 8–26, 1938.

This species is characterized by its small leaflets and the very short pedicels in the fruits. It is near *Heteropanax chinensis* (Dunn) Li, differing from it, aside from the considerably shorter pedicels in fruits, in the leaflets being larger and generally dull above.

3. **Heteropanax chinensis** (Dunn) comb. nov. (descr. ampl.). Fig. 13.

Heteropanax fragrans var. *chinensis* Dunn, Jour. Linn. Soc. Bot. **38**: 360. 1906.

Frutex 2–3 m. altus. Ramis conferte ferrugineo-tomentosis. Foliis pinnatim decompositis 50–60 cm. latis, stipulis minimis obscuris; petiolis 15–30 cm. longis; foliolis ad nodos rachidum omnium oppositis, chartaceis, glabris, supra nitidis, subtus glaucescentibus, elliptico-lanceolatis, 2.5–5.5 cm. longis, 0.8–1.8

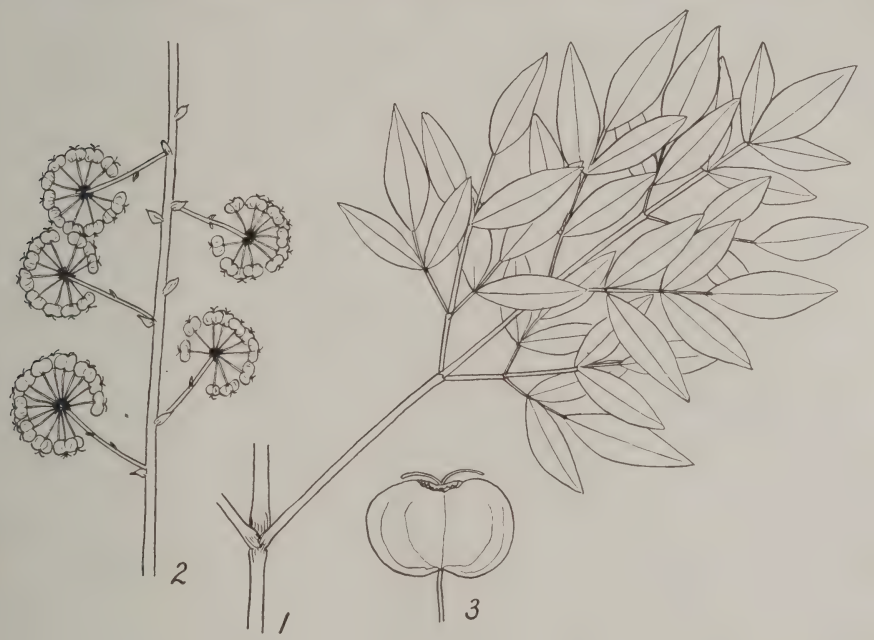

Fig. 13. *Heteropanax chinensis; 1.* portion of leaf, × ½; *2.* portion of infructescence, × ½; *3.* fruit, × 2.

cm. latis, apice longe acuminatis, basi attenuatis, margine integris subrevolutis, nervis lateralibus utrinsecus circa 6, supra inconspicuis, subtus paulo prominentibus; petiolulis nullis vel 1 cm. longis. Inflorescentiis paniculatis ad 30 cm. longis, conferte ferrugineo-tomentosis, floribus luteis fragrantibus (fide collectoris) umbellatis, secus ramulos paniculae racemose dispositis, ramulis 7 cm. longis pauciumbellatis; bracteis ovatis acutis 5 mm. longis; umbellis plurifloris 2 cm. latis; pedunculis 1–1.5 cm. longis, bracteolis 3 mm. longis; pedicellis 4 mm. longis, fructigeris elongatis. Calyce conferte ferrugineo-tomentoso 2 mm. longo, manifeste 5-dentato. Petalis 5 ovatis acutis, 2 mm. longis, extus subtomentosis. Staminibus 5, filamentis 3 mm. longis. Ovario 2-loculari, stylis 2 conspicuis. Fructu rubro-nigrescente (fide collectoris) lateraliter compresso, 8 mm. longo, 2 mm. crasso, stylis 2–3 mm. longis patentibus, pedicellis 1 cm. longis.

YUNNAN: Szemao, *Henry 12865* (isosyntype of *Heteropanax fragrans* var. *chinensis* Dunn, AA, NY, W).

KWANGSI: South of Nanning, Seh-feng-dar-shan, *R. C. Ching 8055* (LU, NY); Shangsze District, Shih Wan Tai Shan, Nam She Village, *W. T. Tsang 24435* (AA, NY), *24584* (AA, NY), *24645* (AA, NY).

A species characterized especially by its small compound leaves, with small, long-acuminate, and attenuate leaflets.

XV. Pentapanax Seemann

Pentapanax Seem. Jour. Bot. **2**: 294. 1864, Revis. Heder. 20. 1868.

Trees or large scandent shrubs. Leaves simply pinnate with 3–9 leaflets, glabrous, the leaflets entire, crenate, or serrate. Flowers perfect or polygamous, racemose or umbellate, when racemose the racemes paniculate, when umbellate the umbels in compound umbels, racemes, or panicles; pedicels articulate under the flower. Calyx 5-dentate. Petals 5 or sometimes 7 or 8, imbricate in bud. Stamens as many as petals, the anthers oblong. Ovary 5- or sometimes 7- or 8-celled. Styles united to summit or free for more than half their length. Fruit globose, 5-celled and angular; seeds laterally compressed; endosperm uniform.

About 10 species, from South America, Australia, and India to Burma and southern China.

Type species: *Pentapanax Leschenaultii* (Wight et Arn.) Seem. (*Hedera Leschenaultii* Wight et Arn.).

Key to Species and Variety

A. Flowers racemosely arranged on ultimate branches of inflorescence. (Section I. *Racemosae* Harms.)
  B. Inflorescence glabrous, the pedicels 1.5 mm. long; styles united nearly to their tips. 1. *P. subcordatus.*
  BB. Inflorescence more or less hirsute, the pedicels 0–1 mm. long; styles in perfect flowers free to half or more their length, recurved ..... 2. *P. racemosus.*
AA. Flowers umbellately arranged on ultimate branches of inflorescence. (Section II. *Umbellatae* Harms.)
  B. Inflorescence paniculate, large, about 30 cm. long, the branches simple or compound, the umbels racemosely arranged ..... 3. *P. Henryi.*
  BB. Inflorescence corymbose, 8–15 cm. long, often with 4 umbels verticillately arranged near middle of branches.
    C. Leaflets mostly 5, chartaceous to subcoriaceous, the margins serrate. 4. *P. Leschenaultii.*
    CC. Leaflets mostly 3, membranaceous to chartaceous, the margins entire. 4a. *P. Leschenaultii* var. *Forrestii.*
  BBB. Inflorescence racemose (i.e. the umbels in simple racemes), small, 10–20 cm. or less long.
    C. Racemes with umbels all pedunculate.
      D. Leaflets ovate-lanceolate; raceme 10 cm. or less long, with 2–8 umbels. 5. *P. parasiticus.*
      DD. Leaflets broadly ovate; raceme 15–20 cm. long, with about 10 umbels. 6. *P. yunnanensis.*
    CC. Racemes with the lower umbels pedunculate, the upper ones sessile, verticillately arranged on axis ..... 7. *P. verticillatus.*

1. **Pentapanax subcordatus** (Wall.) Seem. Jour. Bot. **2**: 295. 1864, Revis. Heder. 22. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 724. 1879; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 299, 311. 1930.

   Hedera subcordata Wall. List no. 4917. 1832, *nomen nudum;* G. Don, Gen. Syst. **3**: 394. 1834.

A small tree with 5-foliolate pinnately compound leaves and 3–8 panicles clustered at ends of branches, the flowers racemosely arranged on the panicle-branches. Leaves long-petiolate; petioles glabrous, about 25 cm. long; leaflets chartaceous, glabrous, petiolulate, ovate-oblong, 10–14 cm. long, 7–10 cm. wide, the apex acuminate, the base rounded to subcordate, the margins subentire to obscurely serrulate, the lateral nerves about 8 on each side, prominent on both surfaces, the tertiary nerves conspicuous on both surfaces; petiolules 0.5–1 cm.

long. Panicles glabrous, to 50 cm. long, the lateral branches about 10 cm. long; flowers racemosely arranged on branches, the pedicels about 1.5 cm. long, glabrous, with a minute linear bracteole at base. Calyx glabrous, the margin 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long, glabrous, reflexed. Stamens 5, the filaments 1.75 mm. long. Ovary 5-celled, the styles united into a column to their tips. Fruit subglobose, obscurely 5-angular.

YUNNAN: Northwest of Tengyueh, *Forrest 26718* (AA, W).

ADDITIONAL DISTRIBUTION: Himalayan region.

This species, together with *Pentapanax racemosus* Seem., differs from other species of the genus in the flowers being racemosely arranged.

2. **Pentapanax racemosus** Seem. Jour. Bot. **2**: 295. 1864, Revis. Heder. 21. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 724. 1879.

A tree 7–20 m. in height, with 5-foliolate pinnately compound leaves and 3–9 panicles clustered at ends of branches, the flowers racemosely arranged on the panicle-branches. Leaves petiolate; petioles about 10 cm. long; leaflets submembranaceous, glabrous, petiolulate, ovate-oblong, 7–13 cm. long, 4.5–8 cm. wide, the apex acuminate, the base obtuse to subcordate, the margins subentire, the lateral nerves about 8 on each side, prominent on both surfaces, the tertiary veins subconspicuous. Inflorescence unisexual, the panicles more or less hirsute, to 50 cm. long, the lateral branches about 6–7 cm. long, sometimes compound; flowers racemosely arranged on the branches, the pedicels 0–1 mm. long, slightly hirsute, with a minute linear bracteole at base. Calyx glabrous, the margin minutely 5-dentate, fimbriate. Petals 5, triangular-ovate, 1 mm. long, glabrous, reflexed. Stamens 5, the filaments 1 mm. long. Ovary 5-celled, the styles in male flowers united nearly to their tips, in imperfect flowers 3–5, recurved and free sometimes nearly to base. Fruit subglobose, very slightly angular, the style-column persistent, the tips distinct and reflexed at about the middle.

YUNNAN: Shunning, Huaiyangpu, *T. T. Yü 16375* (AA); Chenkang, Snow Range, *T. T. Yü 16894* (AA).

ADDITIONAL DISTRIBUTION: Himalayan region.

This species is closely related to *Pentapanax subcordatus* (Wall.) Seem. in that the flowers in both are racemosely arranged on the inflorescence branches, not in umbels. It can be distinguished from the latter by its longer petiolules, more or less hirsute inflorescences, shorter pedicels, fimbriate calyx-margins, and its divergent styles.

3. **Pentapanax Henryi** Harms, Bot. Jahrb. **23**: 21. 1896; Harms ex Diels, Bot. Jahrb. **29**: 489. 1900; Diels, Notes Bot. Gard. Edinb. **7**: 191. 1912; Lévl. Cat. Pl. Yun-Nan 11. 1915; Harms & Rehder in Sargent, Pl. Wils. **2**: 565. 1916; Chung, Mem. Sci. Soc. China **1**: 189. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **14**: 371. 1924, **17**: 236, 262. 1929–30.

Aralia tomentella Franch. Jour. de Bot. **10**: 304. 1896, Pl. Sin. Ecl. Prim. 24. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915; Chung, Mem. Sci. Soc. China **1**: 189. 1924; syn. nov.

Pentapanax Larium Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61**: 121. 1924; syn. nov.

Pentapanax Henryi Harms var. *Larium* Hand.-Maz. Symb. Sin. **7**: 699. 1933; syn. nov.

A shrub 2–5 m. tall, with 3- or 5-foliolate pinnately compound leaves and terminal long panicles formed by numerous umbels. Leaves long-petiolate; petioles 4–11 cm. long; leaflets membranaceous to chartaceous, glabrous above, with very small tufts of pubescence in axils of nerves beneath, short-petiolulate, ovate to ovate-oblong, 5–12 cm. long, 3–7 cm. wide, the apex acute to short-acuminate, the base rounded to obtuse or attenuate, the margins serrate, the lateral nerves about 6–8 on each side, subconspicuous above, distinct and elevated beneath, the tertiary veins obscure above, subconspicuous beneath; petiolules of lateral leaflets

0.5 cm. long, those of median leaflets 1.5–3 cm. long. Inflorescence a long terminal conical panicle formed by numerous umbels, the main axis densely ferruginous-villose, about 30 cm. long, the lateral branches simple or compound, the umbels many-flowered, these racemosely arranged on the branches, the peduncles densely ferruginous-villose, 2–5 cm. long, the bracts ovate, about 5 mm. or more long, the pedicels slender, ferruginous-villose, about 1 cm. long. Calyx glabrous, the margin 5-dentate, the lobes ovate. Petals 5, glabrous, triangular-oblong, 1.5 mm. long, reflexed. Stamens 5, the filaments 2 mm. long. Ovary 5-celled, the styles connate. Fruit ovoid, black, about 6–7 mm. across, the style-column about 2 mm. long, sometimes separate and divergent at tip.

SZECHUAN and SIKANG: No precise locality, *Henry 7035* (G, W); western Szechuan, *Wilson 1311* in part (NY, W); near Tachienlu, *Wilson 1311* in part (AA); near Mupin and Fulin, *Wilson 1311* in part (AA, G); west of Kuan Hsien, Pan-lan-shan, *Wilson 4284* (AA).

YUNNAN: . San-tschan-kiou, *Delavay 3896* (holotype of *Aralia tomentella* Franch., photo. and merotype in AA); Mengtze, *Henry 11278* (AA, NY, W), *11278A* (AA, NY, W); no precise locality, *F. Ducloux 125* (NY); Lichiang, *C. Schneider 2075* (AA); inter fl. Yangtze und Mekong, Djitsung-Kakatang, *Handel-Mazzetti 7875* (isotype of *Pentapanax Larium* Hand.-Maz., AA); no precise locality, *Forrest 11109* (AA), *11120* (AA), *11128* (AA); western flank of Lichiang range, *Forrest 16935* (AA); Sungkwei Range, *Forrest 23032* (AA); between Likiang and Talifu, *J. F. Rock 6564* (AA); no data, *T. T. Yü 10434* (AA); western Likiang, Tamichung, *R. C. Ching 21574* (AA); eastern Likiang, Tai-ngo-koo, *R. C. Ching 21648* (AA); Likiang City, *R. C. Ching 22204* (AA); between Ngerya and Zukou, on the border of Chungtien, *K. M. Feng 2919* (AA); southern Chungtien, Tali on the banks of the Yangtze, *K. M. Feng 2315* (AA); southern Chungtien, Wo-tso on the banks of the Yangtze, *K. M. Feng 3342* (AA).

This species is characterized by the elongated paniculate inflorescence with branches either simple or compound. *Aralia tomentella* Franch. is reduced to synonymy on the basis of a photograph and fragments of the type (in AA). The character used by Handel-Mazzetti to separate the var. *Larium* from the type is trivial and not constant; hence the name is here treated as a synonym. Cheng describes var. *wangshanensis* (Contr. Biol. Lab. Sci. Soc. China **9**: 205. 1934) from Anhwei, but I have seen no specimen. His description is as follows:

"A typo recedit inflorescentia minus tomentosa, squamis umbellarum parvis, lanceolatis, 5–10 mm. longis, stylis omnino cohaerentibus.

"Anhwei: Wangshan, among rocks, alt. 1300 m., W. C. Cheng 4108, bush 2–2.5 m. tall, fruits black, Oct. 18, 1933; same locality, M. Chen no. 1215 (type), Oct. 3, 1933.

"This new variety differs from the type by its less tomentose inflorescence with smaller bracts of the umbels, and by its entirely connate styles. It differs from *P. Henryi* var. *larium* Hand.-Mzt. by its more flowered (25–50) umbels, and by its usually acute calyx lobes and entirely connate styles."

4. **Pentapanax Leschenaultii** (Wight et Arn.) Seem. Jour. Bot. **2**: 296. 1864, Revis. Heder. 22. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 724. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 474. 1911; Diels, Notes Bot. Gard. Edinb. **7**: 116, 117. 1912; Lévl. Cat. Pl. Yun-Nan 11. 1915; Chung, Mem. Sci. Soc. China **1**: 189. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **14**: 270, 309, 352. 1924, **17**: 101, 125, 165, 280, 340. 1929–30; Hand.-Maz. Symb. Sin. **7**: 700. 1933.

Hedera Leschenaultii Wight et Arn. Prodr. **1**: 377. 1834.

Hedera trifoliata Wight et Arn. Prodr. **1**: 377. 1834; Wight, Icon. Plant. Ind. Orien. **1**: 16. *t. 307*. 1840.

A tree of about 10–15 m. tall or a scandent shrub, with 3–5-pinnately compound leaves and terminal corymbose inflorescences composed of 5–10 branches, each branch bearing a terminal umbel and commonly with 4 more umbels verticillately arranged near middle. Leaves petiolate; petioles 10–15 cm. long; leaflets chartaceous to subcoriaceous, glabrous above, pubescent along the nerves or glabrous beneath, short-petiolulate, elliptic-ovate, 6–12 cm. long, 2.5–6 cm. wide, the apex

acuminate, the base rounded, the margins bristly serrate, the lateral nerves 6–10 on each side, subconspicuous above, distinct and elevated beneath, the tertiary veins subconspicuous above, distinct beneath; petiolules 0.3–1 cm. long. Inflorescence terminal, corymbose, about 8–15 cm. long, with 5–10 branches arranged on a short axis 1–2 cm. in length, each branch bearing a terminal umbel and with 0–4 (commonly 4) umbels verticillately arranged near middle, puberulo-pubescent, the umbels many-flowered, 2–2.5 cm. across, the peduncles 1.5–3 cm. long, the pedicels 0.5–1 cm. long, glabrous or puberulo-pubescent. Calyx glabrous, 2 mm. long, 5-dentate. Petals 5, glabrous, 2 mm. long, cohering into an early deciduous calyptra. Ovary 5-celled, the styles connate to nearly their tips. Fruit ovoid, 3–4 mm. long, slightly 5-angular, the style-column 1.5 mm. long.

SZECHUAN: Southeast of Muli, *Forrest 22163* (AA).

YUNNAN: Mengtze, *Henry 9806* (NY); Feng Chen Lin, *Henry 13646* (AA, W); Lidjiang, Yuling-schan, *Handel-Mazzetti 3735* (AA); Likiang, *C. Schneider 2441* (AA, G); inter fl. Salween et Tengyueh, *C. Schneider 3166* (AA); no precise locality, *Forrest 10765* (AA); Sung-kwei Range, *Forrest 21574* (AA, W); Yangtze watershed, District of Likiang, eastern slopes of the Likiang Snow Range, *J. F. Rock 3730* (W), *4482* (AA, W); mountains south of Likiang, Sungkwei Hochin Range, *J. F. Rock 8302* (AA, W); Pin-chuan Hsien, *H. T. Tsai 52982* (AA); Che-tse-lo, *H. T. Tsai 59338* (AA); Likiang Hsien, *C. W. Wang 70979* (AA); Likiang Snow Range, *T. T. Yü 15237;* Upper Kiukiang Valley, Bahlaka, *T. T. Yü 19578* (AA), *19584* (AA); Taron-Taru Divide, Ahtehmai, *T. T. Yü 20050* (AA); Likiang Snow Range, *R. C. Ching 30376* (AA); eastern flank of Likiang Snow Range, *R. C. Ching 30648* (AA).

ADDITIONAL DISTRIBUTION: India to Burma.

In this species, specimens with both 3- and 5-foliolate leaves are included. Most of the specimens studied are with 5-foliolate leaves only. *Tsai 59338* and *Yü 19584* and *20050* bear only 3-foliolate leaves, while *Yü 19578* and *Ching 30648* bear both 3- and 5-foliolate leaves on the same plant. This species is characterized by the corymbose inflorescence with commonly four umbels verticillately arranged near the middle of the branches.

4a. **Pentapanax Leschenaultii** var. **Forrestii** (W. W. Smith) comb. nov.

Pentapanax Forrestii W. W. Smith, Notes Bot. Gard. Edinb. **10:** 58. 1917.

Pentapanax truncicolus Hand.-Maz. Anz. Akad. Wiss. Wien Math.-Nat. Kl. **61:** 200. 1924, Symb. Sin. **7:** 700. 1933; syn. nov.

Leaflets mostly 3, membranaceous to chartaceous, the margins entire.

YUNNAN: Doyonlumba, ad fl. Lidjiang, *Handel-Mazzetti 8321* (isotype of *Pentapanax truncicolus* Hand.-Maz., AA); Wei-si Hsien, Yeh-chih, *C. W. Wang 68287* (AA), *68708* (AA).

Forrest's material, on which Smith's species was based, and Wang's specimens cited above have 3-foliolate leaves only. Handel-Mazzetti's specimen is rather fragmentary. It is an epiphytic form with both 3- and 5-foliolate leaves. Otherwise it agrees with Smith's description and is probably best placed here.

5. **Pentapanax parasiticus** (D. Don) Seem. Jour. Bot. **2:** 296. 1864, Revis. Heder. 22. 1868; Dunn, Jour. Linn. Soc. Bot. **39:** 424. 1911; Chung, Mem. Sci. Soc. China **1:** 189. 1924.

Hedera parasitica D. Don, Prodr. Fl. Nepal. 188. 1825; DC. Prodr. **4:** 265. 1830.

A low scandent shrub with 3–5-foliolate pinnately compound leaves and terminal simple racemes formed by 2–8 umbels. Leaves petiolate; petioles slender, glabrous, 3–6 cm. long; leaflets membranaceous, glabrous, short-petiolulate, ovate-lanceolate, 4–7 cm. long, 2–2.5 cm. wide, the apex acute to acuminate, the base rounded to subacute, the margins entire, the lateral nerves about 6–8 on each side, conspicuous on both surfaces, the tertiary veins manifest on both surfaces; petiolules 3–5 mm. long. Inflorescence of terminal simple racemes of 2–8 umbels, 10 cm. or less long, glabrous, the umbels many-flowered, 2.5–3.5 cm. in

diameter, the peduncles slender, 2–4 cm. long, the bracts ovate, membranaceous, 3–5 mm. long, the pedicels slender, 0.8–1.5 cm. long, glabrous. Calyx glabrous, 5-dentate. Petals 5, triangular-ovate, 2 mm. long, glabrous. Stamens 5, the filaments 2.5 mm. long. Ovary 5-celled, the styles long, united into a column about 1.2 mm. long.

YUNNAN: Chi-na-tung; Champutung, *C. W. Wang 66605* (AA).
ADDITIONAL DISTRIBUTION: India.

This differs from other species of the genus in its simple racemose inflorescences consisting of few umbels, its small leaves, and its rather long style-column. The only specimen cited above has 3-foliolate leaves. Although in the original description 5-foliolate leaves are indicated, Indian specimens available for comparison have both 3- and 5-foliolate leaves. The 3-foliolate leaves may be interpreted as representing intra-specific variation, as is found in various other species of the genus.

6. **Pentapanax yunnanensis** Franch. Jour. de Bot. **10**: 305. 1896, Pl. Sin. Ecl. Prim. 25. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915; Chung, Mem. Sci. Soc. China **1**: 189. 1924; Hand.-Maz. Symb. Sin. **7**: 700. 1933.

A glabrous shrub, with 5-foliolate pinnately compound leaves and terminal racemes formed by few umbels. Leaves long-petiolate; petioles 4–12 cm. long; leaflets chartaceous, glabrous on both surfaces, subsessile to short-petiolulate, broadly ovate, 5–7.5 cm. long, 3.5–5.5 cm. wide, the apex obtuse to acute, the base rounded, the margins serrate, the lateral nerves about 6 on each side, conspicuous on both surfaces, the tertiary veins prominent on both surfaces; petiolules 0–0.5 cm. long, the terminal to 4 cm. long. Inflorescence a terminal raceme formed by about 10 umbels, about 15–20 cm. long, glabrous, the umbels many-flowered, racemosely arranged on the main axis, the peduncles about 2 cm. long, the pedicels 0.8–1 cm. long, glabrous. Calyx glabrous, the margin 5-dentate, the lobes rounded. Petals 5, glabrous. Stamens 5. Ovary 5-celled, the styles connate into a column. Fruits depressed-globose, 4 mm. across, 5-angular.

YUNNAN: In monte Ma-eul-shan, *Delavay s. n.* (HOLOTYPE, merotype in AA); Pelong-tsin, *Maire 6300* (W); Dali, Yidjiatscheang, *Handel-Mazzetti 6424* (AA) (juvenile).

A species characterized by its broadly ovate leaflets and solitary terminal inflorescences, the latter formed by racemosely arranged umbels. This *Pentapanax* resembles certain species of *Aralia,* particularly *A. caesia* Hand.-Maz. and its allies.

7. **Pentapanax verticillatus** Dunn, Jour. Linn. Soc. Bot. **35**: 498. 1903; Chung, Mem. Sci. Soc. China **1**: 189. 1924.

A shrub about 1 m. tall, with 3-foliolate pinnately compound leaves and terminal inflorescences, the flowers in umbels, terminating the main axis and basal branches and also arranged verticillately along the axis, these lateral umbels sessile. Leaves petiolate; petioles 3–5 cm. long, glabrous; leaflets subcoriaceous, glabrous above, glaucous beneath, short-petiolulate, ovate, 5–8 cm. long, 2–3 cm. wide, the apex acute, the base acute to slightly rounded, the margins entire, revolute, the lateral nerves 6–8 on each side, conspicuous on both surfaces, the tertiary veins subconspicuous. Inflorescence terminal, 6–10 cm. long, red-ferruginous-tomentose, branching near base only, the branches about 1.5 cm. long, with large membranaceous bracts at base of inflorescence and of branches, the umbels many-flowered, 1.5–2 cm. across; pedicels slender, about 6–8 mm. long. Calyx glabrous, 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long, glabrous. Stamens 5, the filaments 1.5 mm. long. Ovary 5-celled, the styles united into a single column.

YUNNAN: Mengtze, *Henry 9284* (ISOTYPE, AA, NY, W).

A species, known from the original collection only, characterized by the small inflorescences which are red-ferruginous-tomentose, few-branched at the base only, and with sessile umbels verticillately arranged on the main axis.

XVI. Aralia Linnaeus

Aralia Linn. Syst. ed. 1. 1735; Gen. Pl. ed. 1. 88. 1737, ed. 5. 134. 1754.

Dimorphanthus Miq. Comm. Phytogr. 95. *t. 12.* 1840.

Herbs, shrubs, or small trees, glabrous or hairy, often prickly. Leaves pinnate to tripinnate, with serrate or nearly entire leaflets, exstipulate. Flowers polygamo-monoecious, in umbels, the umbels solitary or several together, usually arranged in racemes or panicles, rarely in compound umbels, the pedicels mostly distinctly articulate under the flower. Calyx-margin minutely 5-dentate. Petals 5, imbricate. Ovary 2–5-celled. Styles 2–5, free or shortly connate at base, the disk fleshy, small, slightly raised at the margin. Fruit 2–5-celled, subglobose, 3–5-angular; seeds compressed; endosperm uniform.

Over thirty species in North America, Asia and Malaya.

Type species: *Aralia spinosa* Linn.

Key to Species and Varieties

A. Herbs.
- *B.* Inflorescence corymbose, the main axis 5 cm. or less long. (Section I. *Anomalae* Harms).
  - *C.* Petiolules of lateral leaflets none or short, 0–1 cm. long.
    - *D.* Leaflets small, 1–3.5 × 1–2 cm., deeply and densely double-serrate...1. *A. apioides.*
    - *DD.* Leaflets large, 3–12 × 1.5–7 cm., serrate or crenate-serrate.
      - *E.* Leaflets ovate or elliptic, sparsely pilose along the veins on both surfaces, the base obtuse to slightly rounded, the margins crenate-serrate .....2. *A. Henryi.*
      - *EE.* Leaflets ovate to oblong-ovate, scabrid on both surfaces, pubescent along the veins beneath, the base cordate, the margins serrate.
        - *F.* Leaflets large, 3–12 × 1.5–7 cm. .....3. *A. Fargesii.*
        - *FF.* Leaflets small, 4.5 × 2 cm. or less .....3a. *A. Fargesii* var. *yunnanensis.*
  - *CC.* Petiolules of lateral leaflets 0.5–2 cm. long .....4. *A. atropurpurea.*
- *BB.* Inflorescence paniculate, the main axis 10 cm. or more long. (Section II. *Genuinae* Harms).
  - *C.* Leaflets large, 4–15 cm. long .....5. *A. cordata.*
  - *CC.* Leaflets small, 2–4.5 cm. long .....6. *A. dumetorum.*

AA. Shrubs or trees.
- *B.* Flowers distinctly pedicellate, umbellate. (Section III. *Arborescentes* Harms).
  - *C.* Plants always more or less armed with prickles or spines.
    - *D.* Stems and branches densely prickly; petiole, rachis, and partial rachises of leaves as well as inflorescences more or less prickly.
      - *E.* Leaves and inflorescences with long prickles and dense, long setose hairs, the prickles 3–10 mm. long .....7. *A. spinifolia.*
      - *EE.* Leaves and inflorescences with short prickles, glabrous or pilose, the prickles less than 4 mm. long.
        - *F.* Pedicels short, 1.5 cm. long, pubescent .....8. *A. armata.*
        - *FF.* Pedicels long, 2–5 cm. long, glabrous or nearly so .....9. *A. foliolosa.*
    - *DD.* Stems and branches densely or sparingly prickly; petiole, rachis and partial rachises of leaves and inflorescences unarmed or occasionally with very few widely scattered prickles.
      - *E.* Inflorescencê corymbose-paniculate, the axis short, the branches subumbellately arranged.
        - *F.* Leaflets undulate-mucronate .....10. *A. undulata.*
        - *FF.* Leaflets serrate, not undulate.
          - *G.* Leaflets subchartaceous, glabrous to slightly pubescent along the veins; inflorescence pubescent .....11. *A. elata.*
          - *GG.* Leaflets coriaceous, fulvous-strigose-tomentose; inflorescence densely fulvous-strigose .....12. *A. Searelliana.*

EE. Inflorescence paniculate, the axis long, the branches racemosely arranged.
F. Pedicels short, 4–6 mm. long.
G. Leaflets glabrous to slightly scabrid above, pubescent especially along the veins beneath .....13. *A. chinensis.*
GG. Leaflets glabrous above, glaucescent and glabrous beneath except the sparingly pubescent midrib .....13a. *A. chinensis* var. *nuda.*
GGG. Leaflets densely yellow-strigose above, densely yellow-strigose-tomentose especially along the veins beneath ....13b. *A. chinensis* var. *dasyphylloides.*
FF. Pedicels long, 0.8–3 cm. long.
G. Leaflets membranaceous to subchartaceous, glabrous. ...14. *A. echinocaulis.*
GG. Leaflets chartaceous to coriaceous, fulvous-tomentose.
H. Umbels many(30–50)-flowered .....15. *A. Decaisneana.*
HH. Umbels fewer(15–20)-flowered .....16. *A. Thomsonii.*
CC. Plants completely unarmed.
D. Leaves once or twice pinnate.
E. Leaves usually once pinnate, 10–16 cm. long, the leaflets ovate to orbicular. 17. *A. caesia.*
EE. Leaves bipinnate, 30–40 cm. long, the leaflets oblong-ovate to ovate-lanceolate. 18. *A. Wilsonii.*
DD. Leaves tripinnate .....19. *A. plumosa.*
BB. Flowers sessile, capitate. (Section IV. *Capituligerae* Harms) ...20. *A. dasyphylla.*

1. **Aralia apioides** Hand.-Maz. Symb. Sin. **7:** 701. *t. 11, f. 7.* 1933.

An herb about 1 m. tall, with thick horizontal rhizomes, 1–3-pinnate leaves, and terminal or axillary corymbose-paniculate inflorescences. Upper leaves often simple- or 2-pinnate, 3–9-foliolate, short-petiolate, the lower leaves 2- or 3-pinnate, to 60 cm. long including the petiole, long-petiolate, the pinnae 2-pinnate, the ultimate pinnules 5–9-foliolate; petioles slender, 2–15 cm. long; leaflets membranaceous, glabrous to slightly pilose-scabrid above, slightly pilose to glabrescent along the veins beneath, short-petiolulate, broadly ovate, 1–3.5 cm. long, 1–2 cm. wide, the apices of terminal leaflets long-acuminate, of lateral ones often obtuse, the base cordate to obtuse, the lateral ones usually slightly oblique, the margins deeply and densely double-serrate (teeth setose-acuminate), the lateral nerves about 4 or 5 on each side, subconspicuous, the tertiary veins inconspicuous above, subconspicuous beneath; petiolules 1–5 mm. long. Inflorescence terminal or axillary, corymbose-paniculate, slightly pilose to glabrescent, to 30 cm. long; flowers in umbels, these racemosely arranged on the branches, 7–10-flowered, the peduncles 1.5–3 cm. long, the pedicels 1–4 mm. long. Calyx glabrous, about 1.5 mm. long, 5-dentate, the lobes triangular-ovate, obtuse. Petals 5, triangular-ovate, about 1 mm. long. Stamens 5. Ovary 3–5-celled, the styles 3–5, distinct. Fruit subglobose, about 4 mm. long, 5-angular.

YUNNAN: Northern flank of Haba Snow Range, *K. M. Feng 1351* (AA).

This species is near to *Aralia Fargesii* Franch. and *A. Henryi* Harms, differing from both in its much smaller leaflets, which are deeply and densely double-serrate.

2. **Aralia Henryi** Harms, Bot. Jahrb. **23:** 12. 1896; Harms ex Diels, Bot. Jahrb. **29:** 490. 1900.

Aralia pilosa Franch. Jour. de Bot. **10:** 302. 1896, Pl. Sin. Ecl. Prim. 21. 1897.

A slender herb, with short rhizome, 3-pinnate leaves, and terminal corymbose-paniculate inflorescences. Leaves about 16–20 cm. long including the petioles, the ultimate pinnules 3-foliolate; petioles 5–8 cm. long, puberulous to glabrous; leaflets membranaceous, sparsely pilose along the veins on both surfaces, the lateral leaflets sessile to subsessile, the terminal petiolulate, ovate or elliptic, 3.5–7.5 cm. long, 2–5 cm. wide, the lateral ones smaller and oblique, the apex acuminate, the base obtuse to slightly rounded, the margins crenate-serrate, the lateral nerves about 6–8 on each side, subconspicuous, the tertiary veins inconspicuous above, subconspicuous beneath; petiolules of terminal leaflets 0.4–2 cm. long.

Inflorescence a terminal corymbose-panicle, the flowers in umbels, these few-flowered, the peduncles 0.5–1 cm. long, the pedicels short, about 2–3 mm. long. Calyx 5-dentate, the lobes obtuse. Petals 5, membranaceous, broadly triangular-ovate, the apex acute to subobtuse. Stamens 5. Ovary 3–5-celled, the styles 3–5, filiform, distinct. Fruit subglobose, about 3 mm. across, 5-angular.

HUPEH: No precise locality, *Henry 6655* (ISOTYPE, G, NY).

3. **Aralia Fargesii** Franch. Jour. de Bot. **10:** 302. 1896, Pl. Sin. Ecl. Prim. 22. 1897; Harms ex Diels, Bot. Jahrb. **29:** 490. 1900; Chung, Mem. Sci. Soc. China **1:** 189. 1924.

An herb about 1 m. tall, with thick elongate rhizome, 1–3-pinnate leaves, and terminal or axillary, subumbellate or corymbose, few-branched inflorescences. Leaves 1–3-pinnate, the upper leaves often simple-pinnate, 3–5-foliolate, the lower 2- or 3-pinnate, 20–45 cm. long including the petioles, the pinnae 1–2-pinnate, the ultimate pinnules 3–5-foliolate; petioles slender, 4–16 cm. long; leaflets membranaceous, scabrid on both surfaces, pubescent along the veins beneath, petiolulate, ovate to oblong-ovate, 3–12 cm. long, 1.5–7 cm. wide, the apex long-acuminate, the base cordate, the lateral ones slightly oblique, the margins serrate, the lateral nerves about 5 or 6 on each side, subconspicuous, the tertiary veins inconspicuous above, subconspicuous beneath; petiolules glabrous to slightly pilose, the lateral ones 0.2–1 cm. long, the terminal 1–2.5 cm. long. Inflorescence terminal or axillary, subumbellate or corymbose, few-branched, the branches 7–22 cm. long, simple or compound, the flowers in umbels, these racemosely arranged on the branches, about 10–20-flowered, 1.4 cm. across, the peduncles 1.5–7 cm. long, glabrous or slightly scabrid, the pedicels 2–4 mm. long, glabrous or slightly scabrid. Calyx slightly scabrid outside, 5-dentate, the lobes broad-triangular. Petals 5, glabrous. Stamens 5. Ovary 5-celled, the styles distinct. Fruit subglobose, whitish, about 5 mm. long, strongly 5-angular.

HUPEH: No precise locality, *Henry 6785* (G, NY, W).

SZECHUAN: Tschen-keou-tin, *Farges s. n.* (HOLOTYPE, photo. in AA).

YUNNAN: No data, *F. Ducloux 169* (NY), *T. T. Yü 14050* (AA); Muli, Consinliang near Ngerya, on the border of Chungtien, *K. M. Feng 2791* (AA).

This species is near *Aralia Henryi* Harms, differing in the shape, indumentum, and serration of the leaflets as indicated in the descriptions. It is also related to *A. cordata* Thunb. but can be distinguished from the latter by its usually smaller leaflets, with more rounded bases, its corymbose inflorescence, and its shorter pedicels.

3a. **Aralia Fargesii** var. **yunnanensis** (Franch.) comb. nov.

Aralia yunnanensis Franch. Jour. de Bot. **10:** 303. 1896, Pl. Sin. Ecl. Prim. 23. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915; Chung, Mem. Sci. Soc. China **1:** 189. 1924.

Differs from the species in the smaller leaflets, these ovate-oblong, 4.5 cm. long, 2 cm. wide, the apex acuminate, the base cordate to subcordate, the margins serrate.

YUNNAN: Kichan, Tapintze, *Delavay 4027* (HOLOTYPE of *Aralia yunnanensis* Franch., photo. and merotype in AA).

Two specimens are cited in the original description of *Aralia yunnanensis* Franch. Fragments and photographs of both in the herbarium of the Paris Museum are in the herbarium of the Arnold Arboretum. The two numbers apparently represent two entirely different species; the first, *Delavay 4027,* is an herbaceous plant, and the second, *Delavay 4581,* is a woody plant. The first one is here treated as the type of his species. It is very similar to *Aralia Fargesii* Franch., the leaves with the same setose surfaces and serrate margins, and the fruits of both are whitish, globose, and strongly 5-angular. It differs from

Aralia Fargesii Franch. in the smaller and narrower leaflets and is here treated as a variety of the latter. See also notes under *A. Wilsonii* Harms.

4. **Aralia atropurpurea** Franch. Jour. de Bot. **10**: 301. 1896, Pl. Sin. Ecl. Prim. 21. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915; Hand.-Maz. Symb. Sin. **7**: 701. 1933.

An herb about 1–1.5 m. tall, with elongated rhizome, 1- or 2-pinnate leaves, and terminal corymbose inflorescence. Upper leaves simple-pinnate, 3–7-foliolate, the lower leaves 1- or 2-pinnate, 20–30 cm. long including the petiole, the pinnae 3-foliolate; petioles 1.5–4 cm. long; leaflets membranaceous, sparsely setose-scabrid on both sides, long-petiolulate, ovate, 3–8 cm. long, 2–3 cm. wide, the apex long-acuminate, the base broad-cuneate, the margins double-serrate, the lateral nerves about 5–7 on each side, subconspicuous, the tertiary veins inconspicuous; petiolules 0.5–2.5 cm. long, the terminal one to 4 cm. long. Inflorescence terminal, corymbose, glabrous to slightly scabrid, the branches to 18 cm. long, usually again umbellately branched at tip, the umbels few-flowered, the peduncles slender, 3–7 cm. long, the pedicels about 1 cm. long. Calyx 1.5 cm. long, the margin 5-dentate, the lobes deltoid, acute. Petals 5, purplish, glabrous, triangular. Stamens 5. Ovary 5-celled, the styles 5, distinct. Fruit globose, about 3.5 cm. across, 5-angled.

Yunnan: Wei-si Hsien, *C. W. Wang 63870* (AA); Mekong-Salwin divide, Sewalongba, *T. T. Yü 22458* (AA).

This species is near *Aralia Henryi* Harms, *A. Fargesii* Franch., and *A. apioides* Hand.-Maz., but can be distinguished from them by its long petiolules and its slender and long peduncles.

5. **Aralia cordata** Thunb. Fl. Jap. 127. 1784; Harms, Bot. Jahrb. **23**: 15. 1896; Dunn, Jour. Linn. Soc. Bot. **39**: 419. 1911; Yabe, Enum. Pl. Manch. 98. 1912; Chung, Mem. Sci. Soc. China **1**: 189. 1924; Nakai, Jour. Arn. Arb. **5**: 28. 1924; Chien, Contr. Biol. Lab. Sci. Soc. China **3**: 68. 1927; Tang, Bull. Fan Mem. Inst. Biol. **2**: 101. 1931.

Aralia edulis Sieb. & Zucc. Fl. Jap. **1**: 57. *t. 25.* 1837; Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868.

Aralia nutans Franch. & Sav. Enum. Pl. Jap. **2**: 376. 1879.

Dimorphanthus edulis Miq. Comm. Phytogr. 96. 1837; Walp. Rep. **2**: 431. 1843.

An herb 1–3 m. tall, with stout spreading branches, large 3–5-pinnate leaves, and long axillary panicles. Petioles 15–30 cm. long; leaflets submembranaceous, glabrous above, slightly pubescent along the veins beneath, subsessile to short-petiolulate, long-ovate to oblong-ovate, 4–15 cm. long, 3–10 cm. wide, the apex abruptly acuminate, the base rounded or cordate, the lateral ones often oblique, the margins coarsely serrate, the lateral nerves about 5–8 on each side, subconspicuous above, distinct and elevated beneath, the tertiary veins inconspicuous above, conspicuous beneath; petiolules 0–2.5 cm. long, the terminal one to 5 cm. long. Inflorescence to 50 cm. long, the branches compound or simple; flowers in umbels, these racemosely arranged on the branches, few- to many-flowered, 1.5–2.5 cm. across, the peduncles 1.5–5 cm. long, slightly pubescent, the bracts small and scale-like, the pedicels 5–10 mm. long, slightly pubescent. Calyx glabrous, 1.5 mm. long, the margin 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, distinct, erect. Fruit globose, 3 mm. across, strongly 5-angled, the styles 5, free or united at base.

Hopei: Eastern Tomb, *H. T. Tsai 50277* (AA); Pao-feng-tze, *C. W. Wang 60812* (AA); Liang-ho-kou, *T. K. Wang & T. S. Wen 694* (AA).

Manchuria: Mukden, f. Jula-dsian, *Maximowicz s. n.* (W); no precise locality, *V. Komarov 1152* (AA).

Anhwei: Whang-shan, *R. C. Ching 2957* (AA, W).

Szechuan: Hung-to-hao and Pan-lan-shan, west of Kuan-hsien, *Wilson 4285* in part (AA).

KWANGSI: Yeo-mer-shan, north of Hin Yen, *R. C. Ching 7151* (LU, NY); no data, *Z. S. Chung 83497* (AA).

ADDITIONAL DISTRIBUTION: Japan.

6. **Aralia dumetorum** Hand.-Maz. Symb. Sin. **7**: 701. 1933.

A suffrutescent herb 1–1.5 m. high, with tripinnate leaves and terminal paniculate inflorescences. Leaves triangular in outline, about 17 cm. long, the pinnae 5–9-foliolate, the ultimate pinnules 3-foliolate; petioles to 4 cm. long; leaflets subchartaceous, short-petiolulate, white-furfuraceous-setose along the veins on both surfaces, ovate to ovate-oblong, 2–4.5 cm. long, 1–2 cm. wide, the apex long-acuminate, the base cordate to subcordate, the margins double-serrate, the teeth mucronate, the lateral nerves about 5–7 on each side, conspicuous on both surfaces, the tertiary veins obscure; petiolules 8–20 mm. long, the terminal one to 45 mm. long. Inflorescence a terminal panicle, the main axis to 15 cm. long, with several axillary long-stalked 1–3-umbellate inflorescences added below, the umbels 12–18-flowered, the peduncles about 2.5 cm. long, slightly pilose, the bracts lanceolate, to 5 mm. long, the pedicels to 7 mm. long. Calyx-margin dentate, the lobes triangular. Petals ovate. Ovary 5-celled, the styles 5, distinct, 0.5 mm. long, erect. Fruit globose, about 7 mm. across, black.

SIKANG: Southwest of Tachienlu, *Wilson 4185* (AA).

This species was originally described by Handel-Mazzetti from Yunnan. It is characterized by the terminal paniculate inflorescence with additional smaller axillary ones below.

7. **Aralia spinifolia** Merr. Philip. Jour. Sci. **15**: 294. 1919; Hand.-Maz. Beih. Bot. Centralbl. **52B**: 172. 1934.

An erect shrub about 3 m. high, with bipinnate, prickly and setose leaves, and large, lax, prickly and setose panicles. Leaves large, the rachis, partial rachises, and leaflets on both surfaces covered with scattered, long, slender, nearly straight prickles and with more numerous slender, spreading setae, the prickles 3–10 mm. long, the setae 1.5–3 mm. in length; pinnae 5–9-foliolate, about 30 cm. long; leaflets membranaceous, subsessile, dark brown or olivaceous when dry, oblong-ovate, 9–12 cm. long, 4–6 cm. wide, the lower surface somewhat paler than the upper, with few scattered spines along midrib and nerves, with more numerous setae scattered all over the epidermis on both surfaces, the apex acuminate, the base rounded, often slightly oblique, the margins serrate, the teeth apiculate, the lateral nerves about 5 or 6 on each side, subconspicuous, the tertiary veins obscure above, slightly impressed beneath. Inflorescence with scattered prickles and dense setae; flowers in umbels, these many-flowered, 2.5 cm. in diameter, the peduncles 1–6 cm. long, setose and prickly, the pedicels 10–15 cm. long, setose. Calyx glabrous, 1.5 mm. long, distinctly 5-dentate, the lobes deltoid, acute, broad. Petals 5, triangular-ovate, 1.5 mm. long, broad. Stamens 5. Ovary 5-celled, the styles 5, distinct. Fruit ovoid, glabrous, about 5 mm. long, prominently 5-angular and deeply 5-sulcate.

KIANGSI: Lungnan District, Oo Chi Shan, near Lam Uk Village, *S. K. Lau 4657* (AA, W); Kiennan District, Sai Hang Cheung, near Tung Li Village, *S. K. Lau 4380* (AA, W).

KWANGTUNG: Chan Tung Hill, *C. O. Levine 3242* (HOLOTYPE, NY, isotype, LU); Yen-wong-chai, Yao-shan, *S. S. Sin 11458* (NY); Wung Yuen District, Tsing Wan Shan, Wong Chuk I, *S. K. Lau 2436* (G).

KWANGSI: An Tsai, *F. A. McClure 3533* = *LU19098* (LU, NY).

FUKIEN: No data, *H. H. Chung 7831* (NY).

This species is characterized by its prickly and setose leaves and inflorescences. The Fukien specimen cited above is doubtfully referred to this species; it consists of a portion of a leafy specimen and a separate portion of an inflorescence. The leaves are doubtless those of *Aralia spinifolia* Merr., but the inflorescence is only

ferruginous-tomentose and not setose nor spiny and resembles that of *A. chinensis* Linn.

8. **Aralia armata** (Wall.) Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 723. 1879; Harms, Bot. Jahrb. **23**: 18. 1896; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1162. *f. 137, 1–4.* 1923; Chung, Mem. Sci. Soc. China **1**: 189. 1924; Merr. Lingnan Sci. Jour. **6**: 283. 1931; Hu, Wang, & Hsia, Fan Mem. Inst. Biol. Bull. Bot. Ser. **8**: 532. 1938.

Panax armatus Wall. List no. 4933. 1832, *nomen nudum;* G. Don, Gen. Syst. **3**: 386. 1834; Walp. Rep. **2**: 429. 1843.

Panax Finlaysonianus Wall. List no. 4936. 1832, *nomen nudum;* G. Don, Gen. Syst. **3**: 386. 1834; Walp. Rep. **2**: 429. 1843.

Aralia Finlaysoniana Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868.

A sparingly prickly shrub, with large 3-pinnate leaves, and prickly, large, paniculate inflorescences. Prickles conical, short, often recurved, the bases broadened. Leaves usually 3-pinnate, with a pair of leaflets at each division of the rachis, the ultimate pinnules 5–9-foliolate, the rachis and partial rachises and petioles prickly; leaflets chartaceous, subsessile, pilose on both surfaces especially along the veins, ovate-oblong, 4–11 cm. long, 2–5 cm. wide, the apex acuminate, the base rounded or cordate, the margins serrate, the lateral nerves 4–6 on each side, subconspicuous, the tertiary veins inconspicuous. Inflorescence a large panicle up to 50 cm. long, prickly, the lower part of the rachis glabrous, the upper part pubescent; flowers in umbels, these many-flowered, 2–2.5 cm. across, the peduncles 1–5 cm. long, the pedicels 1–1.5 cm. long, pubescent. Calyx 2 mm. long, glabrous, distinctly 5-dentate. Petals 5, triangular-ovate, 2 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, distinct, erect. Fruit globose, 4 mm. across, prominently 5-angular.

YUNNAN: Between Keng Hung and Muang Hing, *J. F. Rock 2655* (AA); Ping-pien Hsien, *H. T. Tsai 61854* (AA); Che-li Hsien, Sheau-meng-yeang, *C. W. Wang 75703* (AA), *75850* (AA), *75990* (AA); Che-li Hsien, Dah-meng-lung, *C. W. Wang 77692* (AA); Che-li Hsien, Ban-chiou-chian, *C. W. Wang 79766* (AA).

KWEICHOW: Lohu, *Y. Tsiang 7235* (NY); Do-wan, Chenfeng, *S. W. Teng 90890* (AA).

KWANGSI: Tsin Hung Shan, north of Hin Yen, *R. C. Ching 7064* (AA); Bako Shan, west of Poseh, *R. C. Ching 7680* (AA); San-chiang Hsien, Lao Pao K'ou, *A. N. Steward & H. C. Cheo 1039* (AA); Shang-sze District, Shap Man Taai Shan, Nam She Village, *W. T. Tsang 24745* (AA).

KWANGTUNG: Hongkong, *C. Ford s. n.* (AA, NY); Little Hongkong, *Henry s. n.* (NY).

HAINAN: Ng Chi Leng, *F. A. McClure CCC8474* (LU, NY); Hung Mo Tung, *Tsang & Fung 685 = LU18219* (NY); Taam-chau District, Sha Po Shan, Taai Shui ravine, *W. T. Tsang 680 = LU16179* (AA, NY); Taam-chau District, Hoi Ta Shan, *W. T. Tsang 825 = LU16324* (AA, NY, W); Dung Ka, *N. K. Chun & C. L. Tso 43586* (AA, NY, W); Ching-mai District, Pak Shik Ling, Ku Tung Village, *C. I. Lei 930* (AA); Po-ting, *F. C. How 71964* (AA); Tai-pin, *J. L. Gressitt 1072* (AA).

ADDITIONAL DISTRIBUTION: India, Burma, Indo-China, and the Malay Peninsula.

A species characterized by its prickly stems, leaves, and inflorescences.

9. **Aralia foliolosa** (Wall.) Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 723. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 419. 1911; Chung, Mem. Sci. Soc. China **1**: 189. 1924.

Panax foliolosus Wall. List no. 4928. 1832, *nomen nudum.*

A large, very prickly shrub, glabrous or nearly so, with large, 2- or 3-pinnate leaves and large lax panicles. Prickles short, strong, spreading. Leaves with a pair of leaflets at each division of rachis, the ultimate pinnules 5–9-foliolate, the rachis and partial rachises slightly prickly; leaflets chartaceous, glabrous or minutely pilose above, slightly pilose on nerves beneath, sessile to short-petiolulate, elliptic, 3.5–8 cm. long, 1.5–3 cm. wide, the apex acuminate, the base usually rounded, the margins remotely serrate, the lateral nerves about 6–8 on each side,

subconspicuous above, manifest beneath, the tertiary veins slightly impressed above, subconspicuous beneath; petiolules 0–3 mm. long. Inflorescence a large lax panicle, the branches 30–45 cm. long, glabrous, slightly prickly or unarmed; flowers in umbels, these 10–15-flowered, the peduncles 1–3 cm. long, glabrous or nearly so, the bracts narrowly oblong, to 1 cm. long, membranaceous, persistent, the pedicels 2–5 cm. long, glabrous or nearly so, the bracteoles 1 mm. long, persistent. Calyx glabrous, 2 mm. long, 5-dentate. Petals 5, 2 mm. long, glabrous. Stamens 5, the filaments 3 mm. long. Ovary 5-celled, the styles 5, distinct.

YUNNAN: Szemao, *Henry 11271* (AA, NY).

ADDITIONAL DISTRIBUTION: India.

This species is very near *Aralia chinensis* var. *nuda* Nakai, differing particularly in the glabrous or almost glabrous pedicels and peduncles.

10. **Aralia undulata** Hand.-Maz. Symb. Sin. **7:** 705. *t. 12, f. 6.* 1933.

A sparingly armed shrub, 3–6 m. tall, with large bipinnate leaves and large terminal corymbose panicles. Prickles short, conical. Leaves to 60 cm. long, glabrous; leaflets chartaceous, glaucous beneath, short-petiolulate, ovate to ovate-lanceolate, 7.5–12.5 cm. long, 2.5–5 cm. wide, the apex long-acuminate, the base rounded, the lateral ones more or less oblique, margins slightly undulate-mucronate, the lateral nerves about 9 on each side, subconspicuous above, manifest beneath, the tertiary veins slightly impressed above, conspicuous beneath; petiolules 5 mm. long, the terminal to 2 cm. long. Inflorescence erect, the axis short, the branches subumbellately arranged, to 40 cm. long, racemosely branched; flowers in umbels, the peduncles about 4 cm. long, brownish, furfuraceous-hirsute, bearing a terminal umbel and with or without a few pedicels racemosely or subumbellately arranged beneath, the pedicels 6 mm. long, hirsute, the bracteoles lanceolate, to 17 mm. long, brown, submembranaceous, more or less ciliate at margins. Calyx glabrous, 1.5 mm. long, 5-dentate. Petals 5, oblong, 1.5 mm. long, reflexed. Stamens 5, the filaments 1.5 mm. long. Ovary 5-celled, the styles 5, distinct.

KWANGSI: No data, *R. C. Ching 7119* (LU); San-chiang Hsien, Ling Wang Shan, *A. N. Steward & C. C. Cheo 976* (AA, NY).

This species resembles *Aralia hypoleuca* Presl (1851) = *Aralia bipinnata* Blanco (1837) of the Philippines and Formosa in its leaflet margins, inflorescences, and bracteoles. The leaflets are only slightly undulate, while in *A. hypoleuca* they are distinctly and sharply so. Moreover, in *A. undulata* the inflorescence is more or less brown-hirsute, and with or without few flowers racemosely or subumbellately arranged on the peduncles below the terminal umbels. Handel-Mazzetti's original species is described from a juvenile specimen from Yünshan, southern Hunan. The specimens above referred to this species are flowering ones from Kwangsi.

11. **Aralia elata** (Miq.) Seem. Jour. Bot. **6:** 134. 1868, Revis. Heder. 90. 1868; Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 57. 1894; Nakai, Jour. Arn. Arb. **5:** 30. 1924, Fl. Syl. Koreana **16:** 46. *t. 16.* 1927.

Dimorphanthus elatus Miq. Comm. Phytogr. 95. *t. 12.* 1840; Walp. Rep. **2:** 430. 1843.

Aralia canescens Sieb. & Zucc. Abh. Akad. Muench. **4**(2): 202. 1845 (Fl. Jap. Fam. Nat. **1:** 94).

Dimorphanthus mandshuricus Rupr. & Maxim. Mém. Div. Sav. Acad. Sci. St. Pétersb. **9:** 133. 1859 (Prim. Fl. Amur.).

Aralia Mandshurica Seem. Jour. Bot. **6:** 134. 1868, Revis. Heder. 90. 1868.

Aralia mandshurica Maxim. Bull. Phys.-Math. Acad. Sci. St. Pétersb. **15:** 134. 1856.

Aralia manshurica Komarov, Act. Hort. Petrop. **25:** 123. 1907 (Fl. Mansch. III).

Aralia spinosa Miq. Ann. Mus. Bot. Lugd.-Bat. **1:** 7. 1863, *pro parte;* non Linn.

Aralia spinosa var. *canescens* Sarg. Silva North Am. **5:** 60. 1893.

Aralia chinensis var. *canescens* Koehne, Deutsch. Dendr. 432. 1893; Rehder in Bailey Cycl. Am. Hort. **1**: 88. 1900.

Aralia spinosa var. *glabrescens* Franch. & Sav. Enum. Pl. Jap. **1**: 191. 1875.

Aralia chinensis var. *glabrescens* Schneider, Ill. Handb. Laubholzk. **2**: 431. 1911; Rehder in Bailey, Stand. Cycl. Hort. **1**: 344. 1914.

Aralia chinensis var. *mandschurica* Rehder in Bailey, Cycl. Am. Hort. **1**: 11. 1900, in Bailey, Stand. Cycl. Hort. **1**: 344. 1914; Bean, Trees & Shrubs Brit. Isles **1**: 197. 1914; Chung, Mem. Sci. Soc. China **1**: 189. 1924.

A shrub or tree 5–6 m. tall, the stems usually prickly, the leaves large, bipinnate, the inflorescence large, terminal, corymbose-paniculate. Leaves 40–80 cm. long, often prickly, with a pair of leaflets at each division of the rachis; leaflets subchartaceous, glabrous to slightly pubescent along veins on both surfaces when young, subsessile to short-petiolulate, ovate to ovate-elliptic, 5–12 cm. long, 3.5–7 cm. wide, the apex acuminate, the base rounded to subcordate, the margins serrate with rather broad teeth or remotely serrulate, the lateral nerves 6–8 on each side, prominent on both surfaces, the tertiary veins subconspicuous; petiolules 0.3 mm. long. Inflorescence pubescent, the axis short, the branches panicled, umbellately arranged, 30–45 cm. long, spreading; flowers in umbels, these few- to many-flowered, 1.5 cm. across, the peduncles 1–4 cm. long, the pedicels 6–7 mm. long, pubescent, the bracteoles linear, acute, 3 mm. long, pubescent. Calyx 1.5 mm. long, glabrous, the margin 5-dentate, the lobes acute. Petals 5, triangular-ovate, 1.5 mm. long, reflexed. Stamens 5. Ovary 5-celled, the styles 5, distinct, recurved. Fruit globose, 3 mm. across, 5-angular.

MANCHURIA: Amur River, *R. Maack s. n.* (G); Amur, *Maximowicz s. n.* (G, NY); Kirin, *V. Komarov 1151* (AA); Mifun, *B. V. Skvortzov s. n.* (AA); Hailin, *B. V. Skvortzov s. n.* (AA); Mefuv, *P. H. and J. H. Dorsett 4205* (W); Hsiaoling, *B. V. Skvortzov s. n.* (AA).

ADDITIONAL DISTRIBUTION: Eastern Siberia, Korea, and Japan.

This species is closely related to *Aralia chinensis* Linn., differing in its usually thinner and less tapering leaflets with rather coarse and remote serrations. The inflorescence has a short main axis, with the spreading branches somewhat umbellately arranged.

12. **Aralia Searelliana** Dunn, Jour. Linn. Soc. Bot. **35**: 498. 1903; Chung, Mem. Sci. Soc. China **1**: 189. 1924.

A sparingly prickly tree to 5 m. high, with bipinnate leaves and large corymbose-paniculate inflorescence. Prickles short, conical, straight. Branches, leaves and inflorescences densely fulvous-strigose. Leaves to 2.5 m. long; leaflets coriaceous, sessile to subsessile, fulvous-strigose-tomentose above, densely so especially along veins beneath, ovate, 12–18 cm. long, 7–9 cm. wide, the apex acuminate, the base subcordate to cordate, the margins serrate, the lateral nerves 8–10 on each side, conspicuous beneath, the tertiary veins inconspicuous. Infloresence to 2 m. long, densely fulvous-strigose, the rachis prickly; flowers in umbels, these many-flowered, about 2.5 cm. across, the peduncles 5–8 cm. long, the bracts lanceolate, to 2 cm. long, densely fulvous-strigose, the pedicels about 1 cm. long, fulvous-strigose, the bracteoles lanceolate, 1 cm. or less long, densely fulvous-strigose. Calyx 2 mm. long, glabrous, distinctly 5-dentate. Petals 5, triangular-ovate, 2 mm. long, glabrous. Stamens 5, the filaments 2.5 mm. long. Ovary 5-celled, the styles 4 or 5, erect, free.

YUNNAN: Szemao, *Henry 13426* (photo. of HOLOTYPE and merotype, AA, isotype, AA, NY, W); Ho-kou, *H. T. Tsai 52642* (AA).

This species is related to *Aralia Decaisneana* Hance, but may be readily distinguished by the fulvous-strigose pedicels and peduncles, and by the bracteoles being long, lanceolate, and covered with fulvous, long, strigose hairs.

13. **Aralia chinensis** Linn. Sp. Pl. 273. 1753; DC. Prodr. **4**: 259. 1830; G. Don, Gen. Syst. **3**: 389. 1834; Seem. Jour. Bot. **6**: 133. 1868, Revis. Heder. 90. 1868; Harms, Bot. Jahrb. **23**: 17. 1896; Harms ex Diels, Bot. Jahrb. **29**: 490. 1900; Harms & Rehder in Sargent, Pl. Wils. **2**: 566. 1916; Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1160. 1923; Chung, Mem. Sci. Soc. China **1**: 189. 1924; Nakai, Jour. Arn. Arb. **5**: 31. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **14**: 115. 1924, **17**: 88, 384. 1929–30; Rehder, Jour. Arn. Arb. **8**: 181. 1927; Chien, Contr. Biol. Lab. Sci. Soc. China **3**: 68. 1927; Hand.-Maz. Symb. Sin. **7**: 703. 1933; Chien ex Pei, Contr. Biol. Lab. Sci. Soc. China **10**: 37. 1935; Lee, For. Bot. China 872. 1935.

Aralia chinensis var. *canescens* sensu Dippel, Handb. Laubholzk. **3**: 233. 1893, *pro parte;* Schneider, Ill. Handb. Laubholzk. **2**: 431. 1911; non Koehne.

Aralia spinosa sensu Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 338. 1888, *pro parte;* Courtois, Notes Bot. Chine Mus. Heude **2**: 55. 1933; non Linn.

A shrub or tree 2–8 m. tall, with usually prickly stems, large 2- or 3-pinnate leaves, and large terminal paniculate inflorescences. Leaves 40–80 cm. long, with a pair of leaflets at each division of the rachis, unarmed or with very few prickles; leaflets chartaceous to subcoriaceous, glabrous to slightly scabrid above, pubescent especially along veins beneath, subsessile to short-petiolulate, ovate or broad-ovate, 5–12 (sometimes to 19) cm. long, 3–8 cm. or more wide, the apex acuminate, the base narrowly rounded, the margins closely serrate (teeth small, often accumbent), the lateral nerves about 6–8 on each side, conspicuous above, elevated and prominent beneath, the tertiary veins subconspicuous on both surfaces; petiolules 0–3 mm. long. Inflorescence 25–40 cm. long, pubescent, the branches 20–35 cm. long; flowers in umbels, these many-flowered, 1–1.5 cm. across, the peduncles 1–4 cm. long, the bracts small, membranaceous, 3–4 mm. long, the pedicels 4–6 mm. long, pubescent. Calyx glabrous, 1.5 mm. long, 5-dentate. Petals 5, triangular-ovate, 1.5 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, distinct. Fruit globose, 2–3 mm. across.

Kansu: Ling-si Hsien, *J. Hers 2428* (AA).

Shensi: Lao-y-shan, *J. Giraldi s. n.* (AA).

Shansi: Yuan-chu District, Shih-li-p'o-shan, *H. Smith 6484* (AA).

Honan: Sunghsien, Shih Tze Miao, *J. Hers 1271* (AA); Lushih, Tang Ho, *J. Hers 948* (AA); Kikungshan, *A. N. Steward 9773* (AA, G, W).

Hopei: Eastern Tomb, *C. F. Li 10058* (NY).

Shangtung: Haishan Yuintaishan Ku, *Shangtung Univ. 1037* (AA).

Kiangsu: Haichow Hills, *J. Hers 2274* (AA); I-shing, *R. C. Ching 4868* (AA); I-shing, Hai-wei Monastery, *Y. L. Keng 2635* (AA).

Anhwei: Chiu-hwa-shan, *S. C. Sun 1303* (AA, NY).

Chekiang: No precise locality, *Barchet 193* (W), *Chekiang Univ. LU77369* (LU); Sui-an Hsien, *H. H. Hu 235* (AA); Chin Yen, *R. C. Ching 2364* (AA, LU, W); Tsing Tien, *Y. L. Keng 54* (AA); Tien-tai-shan, *C. Y. Chiao 14297* (AA); Tien-mu-shan, *T. Tang and W. Y. Hsia 156* (AA).

Kiangsi: Kuling, *Wilson 1508* (AA), *A. N. Steward 4753* (AA); Taloushan, Teng-cheng, *Y. Tsiang 10348* (NY).

Hunan: Hsinhwa, Hsikwangschan, *Handel-Mazzetti 805 = 12682* (AA).

Hupeh: No precise locality, *Henry 2104* (G, W), *2535* (W); Patung, Changyang Hsien, Hsing-shan Hsien, and south of Ichang, *Wilson 128* (AA, G, NY, W); western Hupeh, *Wilson 1334* (NY); Siau-ya-tsze, *W. Y. Chun 3622* (AA), *2967* (W); Patung Hsien, *H. C. Chow 708* (AA, NY); Chienshih Hsien, *H. C. Chow 1088* (AA, NY).

Szechuan and Sikang: Kangting Hsien, Tachienlu, *W. P. Fang 3698* (AA); Kuan Hsien, *F. T. Wang 20778* (AA); Mo Hsien, *F. T. Wang 21912* (AA); Lo-shan Hsien, *F. T. Wang 23530* (AA); Mt. Omei, *Y. S. Liu 1483A* (AA), *T. C. Peng 184* (AA), *K. N. Yin 66* (AA).

Yunnan: Shang-pa Hsien, *H. T. Tsai 56580* (AA), *58861* (AA); Chiu-Kiang, west of Champutong, *C. W. Wang 67470A* (AA); Upper Kiukiang Valley, Clulung, Narktai, *T. T. Yü 19603* (AA); Kiukiang Valley, Taron, Muchietu, *T. T. Yü 21029* (AA).

Kweichow: Li-kwan, Tsingchen, *S. W. Teng 90634* (AA).

Fukien: Kuliang Hills, near Foochow, *J. B. Norton 1362* (W); Minchow Hsien, Pehling, *H. H. Chung 2135* (AA); Kushan, Foochow, *H. H. Chung 8285* (AA).

This species is related to the American *Aralia spinosa* Linn. It differs from the latter in that it is usually a smaller plant, less prickly, and with leaflets subsessile or short-petiolulate instead of distinctly petiolulate.

13a. **Aralia chinensis** var. **nuda** Nakai, Jour. Arn. Arb. **5**: 32. 1924; Rehder, Jour. Arn. Arb. **8**: 181. 1927, **9**: 100. 1928, **15**: 116. 1934; Hand.-Maz. Symb. Sin. **7**: 703. 1933; Lee, For. Bot. China 872. 1935.

Aralia chinensis var. *glabrescens* sensu Harms & Rehder in Sargent, Pl. Wils. **2**: 567. 1911; Chung, Mem. Sci. Soc. China **1**: 189. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **14**: 261. 1924; non Schneider.

Aralia chinensis α *elata* Dippel, Handb. Laubholzk. **3**: 233. 1893.

Aralia stipulata Franch. Jour. de Bot. **10**: 304. 1896, Pl. Sin. Ecl. Prim. 23. 1897; Lévl. Cat. Pl. Yun-Nan 11. 1915; Chung, Mem. Sci. Soc. China **1**: 189. 1924; Hand.-Maz. Symb. Sin. **7**: 704. 1933; syn. nov.

Eleutherococcus Mairei Lévl. Rep. Sp. Nov. **13**: 342. 1914, Cat. Pl. Yun-Nan 11. 1915.

Leaflets glaucescent and glabrous beneath except the sparingly pubescent midrib. Inflorescences puberulous, the main axis glabrescent.

KANSU: Lien Hoa Shan, *J. F. Rock 13215* (AA), *13481* (AA); Upper Tebbu country, Yiwaku Valley, *J. F. Rock 14572* (AA); Lower Tebbu country, Wantsang Valley, *J. F. Rock 14673* (AA, W), *14825* (AA); Upper Tebbu country, Yiwaku, south of Drakana, *J. F. Rock 15085* (AA).

SHENSI: Tai-pei-shan, *W. Purdom 1* (AA).

HONAN: Lushih, Lao Kuin Shan, *J. Hers 1151* (AA) (sterile).

HOPEI: No locality, *Père Chanet s. n.* (AA); eastern Tomb, *H. T. Tsai 50222* (AA).

HUNAN: Changnung Hsien, *C. S. Fan and Y. Y. Li 307* (AA).

HUPEH: Southern Wu-shan, *Wilson 128A* (AA); Mt. Eriora, *C. Silvestri s. n.* (AA).

SZECHUAN: No precise locality, *Wilson 3692* (AA); Kuan Hsien, *Wilson 4386* (AA); Min Valley, Mao-chou, *Wilson 4560* (AA); Mt. Omei, *W. P. Fang 2876* (AA); Sungpan Hsien, *W. P. Fang 4389* (AA); Tsing-chuan-fin Hsien, *F. T. Wang 22362* (AA); Mt. Omei, *F. T. Wang 23346* (AA); Huei-li Hsien, *T. T. Yü 1529* (AA).

YUNNAN: South of Red River from Manmei, *Henry 9479* in part (AA, NY, W); Mengtze, *Henry 9479C* (NY); no precise locality, *E. E. Maire 6815* (NY), *7369* (NY); Lou Ke Luin, *R. P. Maire 6816* (NY); Yang-in Chan, *Delavay 2924* (holotype of *Aralia stipulata* Franch., photo. AA, NY, merotype, AA); Likiang, *C. Schneider 2335* (AA), *2675* (AA); Yuling Shan, Likiang, *Handel-Mazzetti 4381* (AA, W); between the Mekong and Salween, *Handel-Mazzetti 1009* (AA); Pe Yen Tsin, *S. Ten 533* (AA); no data, *Forrest 10814* (AA), *10934* (AA); Mekong-Salwin divide, *Forrest 19789* (AA, W); Chien-chuan-Mekong divide, *Forrest 21477* (AA); eastern slope of Mt. Dyinaloko, Likiang Snow Range, *J. F. Rock 10408* (AA, W); Wei-si Hsien, *H. T. Tsai 57886* (AA), *59765* (AA); no data, *H. T. Tsai 57355* (AA), *57450* (AA), *57665* (AA); Wei-si Hsien, Yeh-chih, *C. W. Wang 68220* (AA); no data, *T. T. Yü 7520* (AA), *13444* (AA); Chungtien, Haba, *T. T. Yü 13493* (AA); Muli, near Lamasery, *T. T. Yü 14162* (AA); northwestern Likiang, Tamichung, *R. C. Ching 21455* (AA); Muli, Lamachang near Ngerya on the border of Chungtien, *K. M. Feng 2881* (AA).

KWANGTUNG: Canton, *C. O. Levine CCC1851* (G, LU).

Aralia stipulata Franch. seems to be identical with this variety and is here treated as a synonym. This variety has, in general, smaller leaflets and longer pedicels than the species.

13b. **Aralia chinensis** var. **dasyphylloides** Hand.-Maz. Symb. Sin. **7**: 704. 1933, Beih. Bot. Centralbl. **52B**: 172. 1934; Chun, Sunyatsenia **2**: 78. 1934.

Leaflets densely yellow-strigose above, densely yellow-strigose-tomentose especially along the veins beneath. Pedicels short, 2–3 mm. long.

KIANGSI: Kiennan District, Sai Hang Cheung near Tung Lei Village, *S. K. Lau 4224* (AA, W), *4363* (AA, W).

HUNAN: Hsinhwa, Hsikwangschan, *Handel-Mazzetti 806 = 12662* (AA, LU).

KWANGSI: Kwei-lin District, Che-fen-shan, Hsichang Village, *W. T. Tsang 28388* (AA).

KWANGTUNG: Lochang, *Y. Tsiang 1216* (AA).

14. **Aralia echinocaulis** Hand.-Maz. Symb. Sin. **7:** 704. *t. 11, f. 8.* 1933; Chun, Sunyatsenia **4:** 247. 1940.

A small tree about 3 m. tall, with densely armed branches, large bipinnate leaves, and a long terminal panicle. Prickles slender, straight, 7–14 mm. long. Leaves 35–50 cm. or more long, glabrous, the pinnae 5–7-foliolate; leaflets membranaceous to subchartaceous, glabrous and dark green above, pale and glaucous beneath, sessile or short-petiolate, ovate-oblong to lanceolate, 4–11.5 cm. long, 2.5–5 cm. wide, the apex long-acuminate, the base rounded to cuneate, the lateral ones oblique, the margins finely and remotely mucronulate to serrulate, the lateral nerves about 6–9 on each side, prominent on both surfaces, the tertiary veins slightly impressed above, subconspicuous beneath. Inflorescence subsessile, 30–50 cm. long, brownish, furfuraceous-hirsute, the axis soon glabrescent; flowers in umbels, these 12–20-flowered, the peduncles 2–5 cm. long, the bracts ovate-lanceolate, to 10 mm. long, the pedicels 15–30 mm. long, the bracteoles lanceolate, to 4 mm. long. Calyx glabrous, 5-dentate, the lobes triangular-ovate. Petals ovate-oblong, 2 mm. long. Stamens 5, the filaments 4 mm. long. Ovary 5-celled, the styles 5, distinct. Fruit globose, 5-angular, 2–3 mm. in diameter, the styles 1–1.5 mm. long, reflexed.

Chekiang: No precise locality, *Chekiang Univ. LU77370* (LU); Chang Hua, *F. N. Meyer 1569* (AA, NY); Wenchow, *R. C. Ching 1871* (AA, W); Tien-moo-shan, *R. C. Ching 5045* (AA); Tsing-yun District, *Y. L. Keng 451* (AA).

Anhwei: Southern Chiu-hwa Shan, *R. C. Ching 2840* (AA, LU).

Kiangsi: Pinghsian, *Wang-Te-Hui 228* (isoparatype, AA); Kouling, Tsoongjen, *Y. Tsiang 10131* (NY).

Hunan: Wukang, Mt. Yun-schan, *Handel-Mazzetti 691 = 12254* (isotype, AA, LU).

Kwangsi: Yeo-mar Shan, north of Hin Yen, *R. C. Ching 7119* (NY); Ling-chuan District, Ta-ling, Yang-wu Village, *W. T. Tsang 27936* (AA); Tsu Yuen District, *Z. S. Chung 83536* (AA).

Kwangtung: Kon-ken, Yao-shang, *S. S. Sin 9569* (LU, NY).

This species is similar to *Aralia chinensis* var. *nuda* Nakai in appearance. It may be distinguished by its thinner leaflets, densely armed branches, slender and long prickles, and longer pedicels and filaments. *Ching 7119,* cited above, is very fragmentary.

15. **Aralia Decaisneana** Hance, Ann. Sci. Nat. V. Bot. **5:** 215. 1866; Seem. Jour. Bot. **6:** 133. 1868, Revis. Heder. 90. 1868; Nakai, Jour. Arn. Arb. **5:** 32. 1924; Merr. & Chun, Sunyatsenia **5:** 152. 1940.

Aralia Planchoniana Hance, Jour. Bot. **4:** 172. 1866; Seem. Jour. Bot. **6:** 133. 1868, Revis. Heder. 90. 1868; syn. nov.

Aralia spinosa sensu Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 338. 1888, *pro parte;* Dunn & Tutch. Kew Bull. Add. Ser. **10:** 118. 1912; non Linn.

Aralia chinensis sensu Benth. Fl. Hongk. 135. 1861; Harms, Bot. Jahrb. **23:** 17. 1896; Merr. Lingnan Sci. Jour. **5:** 140. 1928; non Linn.

A sparingly prickly and fulvous-tomentose shrub to 3 m. high, with large bipinnate leaves and large terminal panicles. Branches, petioles, and inflorescences densely fulvous-tomentose. Prickles slender, short, straight. Leaves with a pair of leaflets at each division of the rachis, the pinnae 7–11-foliolate; leaflets coriaceous, fulvous-tomentose above, densely fulvous-tomentose beneath especially along the veins, subsessile to short-petiolulate, ovate to oblong-ovate, 8–15 cm. long, 4–8 cm. wide, the apex acuminate, the base rounded to subcordate, the margins serrulate, the lateral nerves 6–8 on each side, subconspicuous above, prominent beneath, the tertiary veins obscure; petiolules 0–5 mm. long, the terminal one to 5 cm. long. Inflorescence villose-tomentose, the branches to 50 cm. long; flowers in umbels, these 30–50-flowered, 2.5 cm. across, the peduncles 3–4 cm. long, the bracts 1 cm. long, the pedicels about 1 cm. long, tomentose, the bracteoles 3 mm. long, persistent. Calyx glabrous, 2 mm. long, distinctly

5-dentate. Petals 5, triangular-ovate, 2 mm. long, glabrous. Stamens 5, the filaments 2.5 mm. long. Ovary 5-celled, the styles 5, united at base, distinct above. Fruits globose, 4 mm. across, 5-angled.

KIANGSI: Lungnan District, Oo Chi Shan, near Lam Uk Village, *S. K. Lau 4756* (AA, W).

YUNNAN: Mengtze, *Henry 9479* in part (NY, W); Szemao, *Henry 9479A* (NY), *9479B* (AA, W).

KWEICHOW: Tushan, *Y. Tsiang 6884* (NY) (sterile).

KWANGSI: Wuchow, *Tang Sui Pan 6 = LU19126* (LU, NY); Me-Kon, Seh-feng-dar-shan, south of Nanning, *R. C. Ching 8459* (LU, NY); Waitsap District, Tou Ngaok Shan, near Tung Chung Village, *W. T. Tsang 23298* (AA); Wuchow, *C. C. Wang 257* (LU), *303* (LU); Shang-sze District, Shap Man Taai Shan, Nam She Village, *W. T. Tsang 24727* (AA, NY).

KWANGTUNG: Macao, *H. F. Hance 12693* (isotype of *Aralia Planchoniana* Hance, G); Honam Island, *C. O. Levine CCC418* (LU); Canton, *Levine CCC1702* (G, LU, W), *CCC1853* (G, LU, W); Ying Tak, Wan Tong Shan, *Tai Tsan LU14780* (LU); Fan Hsia Shan, *W. Y. Chun 5548* (AA); Hongkong, *N. K. Chun 40221* (NY, W); Lofoushan, *H. T. Ho 60146* (NY); Wung-young District, *S. K. Lau 756* (AA, NY).

HAINAN: Pat Ka Liang, Nodoa, *F. A. McClure 1350 = CCC8044* (AA, LU, NY); Fan Yah, *N. K. Chun & C. L. Tso 44007* (AA, NY, W); no precise locality, *C. Wang 33919* (AA, NY), *34583* (NY); no precise locality, *H. Y. Liang 63389* (AA, NY, W), *64627* (NY); Kan-en District, Chim Fung Mt. near Sha Mo Kwat Village, *S. K. Lau 4994* (AA); Manning, *F. C. How 73958* (AA).

FUKIEN: Amoy, Nanputo, *H. H. Chung 4824* (AA); Amoy, Nanputo near the Amoy District Court House, *H. H. Chung 4528* (AA, LU); Nanputo, *H. H. Chung 5900* (AA, LU).

ADDITIONAL DISTRIBUTION: Formosa.

This species is related to *Aralia dasyphylla* Miq., from which it may be distinguished by its pedicellate flowers and fruits. It also simulates *A. chinensis* var. *dasyphylloides* Hand.-Maz. in appearance, but the longer peduncles, larger umbels, and longer pedicels differentiate it from the latter. Many of the specimens cited above have been referred in herbaria to either *A. dasyphylla* or *A. chinensis* Linn. *Aralia Planchoniana* Hance is a smaller-leaved form of *Aralia Decaisneana*.

16. **Aralia Thomsonii** Seem. Jour. Bot. **6**: 134. 1868, Revis. Heder. 91. 1868; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 723. 1879; Dunn, Jour. Linn. Soc. Bot. **39**: 419. 1911; Chung, Mem. Sci. Soc. China **1**: 189. 1924; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 343. 1930.

A large armed shrub, all parts soft-fulvous-villose, with large 2- or 3-pinnate leaves and large paniculate inflorescence. Prickles short, strong. Leaves with a pair of leaflets at each division of the rachis, the ultimate pinnules 5–9-foliolate; leaflets chartaceous to subcoriaceous, soft-fulvous-villose especially along the veins on both surfaces, subsessile to short-petiolulate, elliptic, 7–15 cm. long, 3–7 cm. wide, the apex long-acuminate, the base rounded to subcordate, the margins sparingly (often very obscurely) serrate, the lateral nerves about 8–10 on each side, subconspicuous above, prominent beneath, the tertiary veins obscure above, subconspicuous beneath; petiolules 0–3 mm. long. Inflorescence to 50 cm. long, soft-fulvous-villose; flowers in umbels, these 15–20-flowered, the peduncles 1–5 cm. long, the bracts narrowly lanceolate, 6 mm. long, the pedicels 0.8–1 cm. long, villose, the bracteoles 4–5 mm. long, persistent. Calyx glabrous, 1.5 mm. long, 5-dentate. Petals 5, 1.5 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, distinct. Fruits globose, 3.5 mm. across, 5-angled.

YUNNAN: No precise locality, *Forrest 18503* (AA); between Muang Hun and Muang Hai, *J. F. Rock 2417* (AA); Fo-hai, *C. W. Wang 74261* (AA), *74622* (AA), *74892* (AA), *77283* (AA); Che-li Hsien, Sheau-meng-yeang, *C. W. Wang 75510* (AA), *75696* (AA); Che-li Hsien, Meng-soong, Dah-meng-lung, *C. W. Wang 78394* (AA); Shunning, Tehseling, *T. T. Yü 17622* (AA).

ADDITIONAL DISTRIBUTION: India.

This species resembles *Aralia chinensis* Linn., differing in its long-pedicellate flowers. It is very near to *A. Decaisneana* Hance, from which it may be distinguished by its fewer-flowered umbels.

17. **Aralia caesia** Hand.-Maz. Symb. Sin. **7**: 702. 1933.

Aralia staphyleina Hand.-Maz. Symb. Sin. **7**: 703. *t. 11, f. 6.* 1933, syn. nov.

A shrub or tree, glabrous, unarmed, with usually 1-pinnate leaves and terminal subsessile panicles. Leaves 5–7-foliolate, 10–16 cm. long including petioles; petioles 2.5–7 cm. long; leaflets subcoriaceous, dark green above, glaucous beneath, the lower leaflets short-petiolulate, often compound and 3-foliolate, the upper sessile, the terminal sessile to petiolulate, generally ovate to orbicular, 2.5–6 cm long, 2–5 cm. wide, the apex shortly cuspidate to acuminate, the base rounded to truncate, the margins minutely denticulate, the lateral nerves 4–6 on each side, prominent on both surfaces, the tertiary veins conspicuous on both surfaces; petiolules 0–1 cm. long, the terminal 0–3 cm. long. Inflorescence to 30 cm. long, lax, glabrous, the branches to 15 cm. long; flowers in umbels, these 7–25-flowered, the peduncles 1.5–4 cm. long, the bracts lanceolate, scariose, about 5 mm. long, the pedicels 4 mm. long, elongating to 15 mm. in fruit, the bracteoles minute. Calyx glabrous, 2 mm. long, 5-dentate, the lobes ovate. Petals ovate-oblong, 2.5 mm. long, reflexed. Stamens 5. Ovary 5-celled, the styles 5, distinct, erect. Fruit globose, about 4–6 mm. across, 5-angled.

YUNNAN: No precise locality, *Henry 10622* (AA), *11244* (AA); Chungtien, *Handel-Mazzetti 4410* (ISOTYPE, AA); Sikang, Shinagcheng, Tungsung, *T. T. Yü 13406* (AA); northern flank of Haba Snow Range, *K. M. Feng 1326* (AA).

This species is near *Aralia Wilsonii* Harms, being unarmed, but is readily distinguished by its usually once pinnate leaves. Among the different species of *Aralia,* this most nearly approaches *Pentapanax,* particularly *P. yunnanensis* Franch., the two species serving as links between the two closely related genera. In *Aralia staphyleina* Hand.-Maz., as described, I fail to find any constant characters by which it may be differentiated from *A. caesia,* and hence I placed the former as a synonym.

18. **Aralia Wilsonii** Harms in Sargent, Pl. Wils. **2**: 567. 1916; Chung, Mem. Sci. Soc. China **1**: 189. 1924.

Aralia yunnanensis sensu Hand.-Maz. Symb. Sin. **7**: 703. 1933; non Franch.

An unarmed shrub 2–3 m. tall, with subglabrous to minutely puberulous branches, bipinnate leaves, and long terminal sessile panicles. Leaves long-petiolate, 20–40 cm. long including petiole, often with a pair of leaflets at each division of the rachis; leaflets chartaceous to coriaceous, glabrous, or scattered-strigose or tomentose on either or both surfaces, dark green above, glaucous beneath, sessile to subsessile or short-petiolulate, oblong-ovate to ovate-lanceolate, 2–5 cm. long, 1.5–2.5 cm. wide, the apex acute to acuminate, the base obtuse to rounded, rarely slightly cuneate, the lateral ones usually oblique, the margins sharply and slightly irregularly serrulate to double-serrate, the lateral nerves about 6 on each side, conspicuous on both surfaces, the tertiary veins elevated and distinct on both surfaces; petiolules 0–4 mm. long, the terminal one to 1.5 cm. long. Inflorescence-branches glabrous to subglabrous, racemosely or subumbellately arranged; flowers in umbels, these many-flowered, long-pedunculate; peduncles slender, 3–6 cm. long, the pedicels 12–18 mm. long, glabrous to subglabrous. Calyx glabrous, 2–3 mm. long, 5-dentate, the lobes ovate, obtuse. Petals 5, triangular-ovate, 2 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, distinct, recurved. Fruit subglobose, distinctly 5-angled, 5 mm. in diameter.

SZECHUAN: Without precise locality, *Wilson 3717* (isoparatype, AA); Ching-chi Hsien, Fei-Yeun-ling, *Wilson 1964* (ISOTYPE, AA, W); affluentem fluminis Yalung versus Yenyuen,

Handel-Mazzetti 2066 (AA); inter Pechicho et Kalapa, *C. Schneider 1220* (AA); Yen-yuan Hsien, Kalapa, *C. Schneider 1221* (AA); Taitiaoko, *C. Schneider 3891* (AA); mountains between the Likiang and Shou-chu Rivers, between Wa-erh-dje and Gaṛu, *J. F. Rock 16900* (AA); Muli, between Baurong and Kulu, west of Yalung River, *J. F. Rock 17820* (AA, NY, W).

YUNNAN: Between Likiang, Youngning and Youngpei, en route to Muli, *J. F. Rock 5083* (AA); Yangtze watershed, District of Likiang, eastern slopes of the Likiang Snow Range, *J. F. Rock 3953* (AA); western slope of Likiang Snow Range, Yangtze watershed, *J. F. Rock 8544* (AA); no data, *H. T. Tsai 57283* (AA), *57357* (AA); Muli, between Ngerya to Zukou, *K. M. Feng 2916* (AA).

This species is variable in the size and in the indumentum of its leaflets as well as the length and number of pedicels. However, the specimens cited above in general agree well with each other in most characters and should be treated as one species. Franchet described *Aralia yunnanensis* on the basis of two specimens. The first one, *Delavay 4027,* which should be designated as the type, is an herbaceous plant and is placed as a variety of *Aralia Fargesii* Franch. The second specimen, *Delavay 4581* in the herbarium of Paris Museum, labeled as *Aralia yunnanensis* Franch. var. *reticulata* Franch. (photo. and merotype in AA), I consider to be identical with the smaller-leaved forms cited above under *Aralia Wilsonii.* Other specimens of the form include *Rock 16900, 17820,* and *Feng 2916,* which are only slightly different from the others in the leaflets being more tomentose beneath, while most specimens are glabrous or nearly so.

19. **Aralia plumosa** sp. nov. Fig. 14.

Frutex inermis glaber. Foliis validis, totis 15–20 cm. longis, pluries 3-pinnatis, petiolo communi ad apicem dichotomiisque foliolis 2 majoribus instructis, illis petioli communis interdum decomposite 3–5-foliolatis, reliquis omnibus simplicibus; foliolis propriis coriaceis, supra scabridis, subtus plus minusve dense tomentosis, sessilibus vel breviter petiolulatis, petiolulis saepe ad basim barbatis, ovatis vel ovato-oblongis, 1.5–4 cm. longis, 1–2 cm. latis, apice acuminatis, basi rotundatis vel subcordatis, margine acute atque irregulariter serratis vel duplicato-serratis, nervis lateralibus utrinsecus 4 vel 5, utrinque conspicuis, venis tertiariis conspicuis; petiolulis 0–5 mm. longis. Inflorescentiis terminalibus paniculatis subsessilibus magnis, ad 30 cm. longis, glabris, ramulis racemose vel subumbellatim dispositis, floribus umbellatis, umbellis multifloris ad 3 cm. crassis, pedunculis 2–9 cm. vel ultra longis, pedicellis 1–1.5 cm. longis. Calyce glabro 2 mm. longo 5-dentato. Petalis 5 oblongo-ovatis, 3 mm. longis, glabris, reflexis. Staminibus 5, filamentis 2 mm. longis. Ovario 5-loculari, stylis 5 erectis ad basim connatis. Fructu globoso 4 mm. diametro pentagono.

YUNNAN: No data, *T. T. Yü 6320* (AA), 1937, *7337* (TYPE, AA), 1938.

This species is near *Aralia Wilsonii* Harms. The leaflets are scabrid on the upper surface and more or less densely tomentose beneath. In the compound leaves the lowest pairs of pinnae are usually subtended by an extra pair of smaller pinnae, the latter mostly 3–5-foliolate, but often one of each pair reduced to a simple leaflet.

20. **Aralia dasyphylla** Miq. Fl. Ind. Bat. **1**(1): 751. 1855, Bonplandia **4**: 138. 1856, Ann. Mus. Bot. Lugd.-Bat. **1**: 9. 1863; Seem. Jour. Bot. **6**: 136. 1868, Revis. Heder. 92. 1868; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 337. 1888; Harms, Bot. Jahrb. **23**: 19. 1896; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 118. 1912.

A sparingly prickly shrub, with bipinnate leaves and large corymbose panicles, the flowers sessile and capitate at ends of peduncles. Prickles straight, short, conical, slender, to 5 mm. long. Young parts densely brown-pubescent. Leaves to 70 cm. long, the petioles, rachis, and partial rachises sparingly prickly or unarmed, densely brown-pubescent, the pinnae 7–9-foliolate; leaflets subcori-

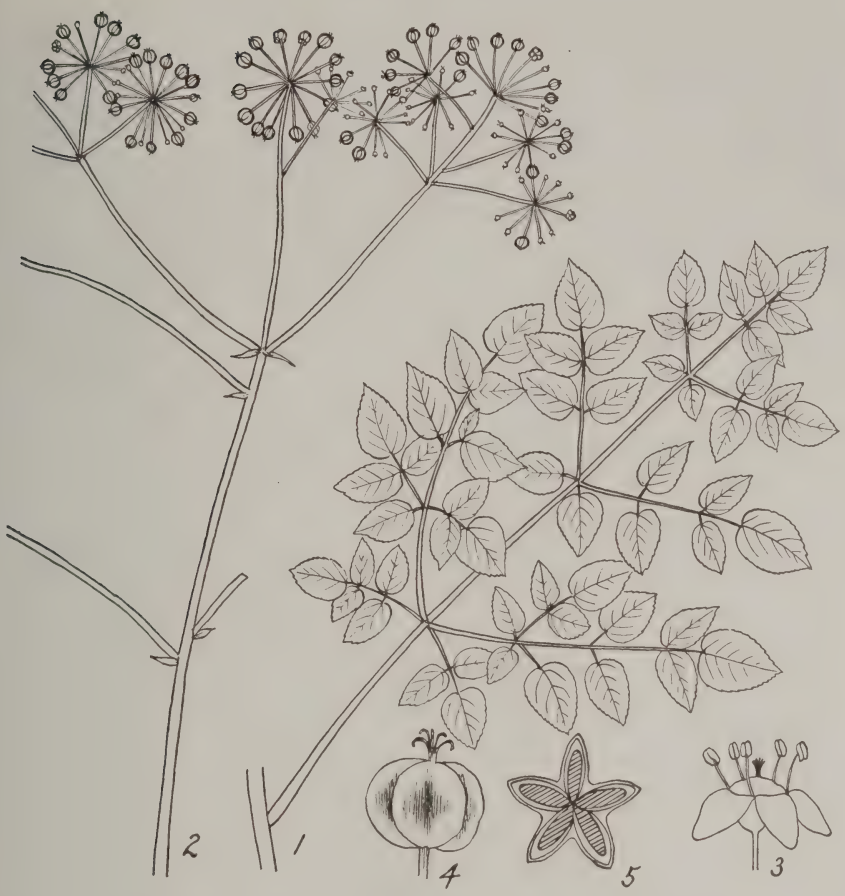

Fig. 14. *Aralia plumosa; 1.* leaf, × ½; *2.* portion of infructescence, × ½; *3.* flower, × 5; *4.* fruit, × 4; *5.* diagrammatic cross-section of fruit, × 4.

aceous, subsessile to short-petiolulate, densely brown-pubescent on both surfaces, ovate to oblong-ovate, 5.5–11 cm. long, 3–5 cm. wide, the apex acuminate, the base rounded to subcordate, the lateral ones slightly oblique, the margins mucronate-serrulate, the lateral nerves 7–10 on each side, subconspicuous above, prominent beneath, the tertiary veins inconspicuous; petiolules 0–5 mm. long, the terminal one to 4 cm. long, densely brown-pubescent. Inflorescence densely brown-pubescent, the lateral branches 20 cm. long, the flowers sessile, several together at ends of peduncles, capitate; peduncles long or short, 0.5–1.5 cm. long, densely pubescent, the bracteoles oblong, persistent. Calyx 2 mm. long, glabrous, the margin distinctly 5-dentate. Petals 5, 1.5 mm. long, glabrous. Stamens 5. Ovary 5-celled, the styles 5, connate at base, distinct above. Fruit globose, 3.5 mm. across, 5-angled.

KWEICHOW: Tai Ho Yen, Fan Ching Shan, *Steward, Chiao, & Cheo 829* (AA, NY, W). KWANGTUNG: Ying Tak, Paak Tuen Shek, Taai Tsin, *W. T. Tsang & K. C. Wong 2320 = LU14181* (LU); Yang-chi, Yao Shan, *S. S. Sin 11517* (LU, NY); Tapu District, Tung Koo Shan, *W. T. Tsang 21777* (NY); Loh-chang District, Chong Yen Shan near Kan Fung, Tin Tong Kin, *W. T. Tsang 20811* (NY, AA); Wung Yuen District, Tsing Wan Shan, Wong Chuk I, *S. K. Lau 2323* (G).

ADDITIONAL DISTRIBUTION: Malay Archipelago.

This species is characterized by its sessile capitate flowers.

Excluded Species

Aralia Labordei Lévl. Bull. Acad. Géogr. Bot. **24:** 144. 1914 = *Toddalia asiatica* (L.) Lam. of the Rutaceae (See Rehder, Jour. Arn. Arb. **14:** 226. 1933).

XVII. Panax Linnaeus

Panax Linn. Syst. ed. 1. 1735, Gen. Pl. ed. 2. 105. 1742, ed. 5. 481. 1754, *pro parte.*

Glabrous herbs, the digitately compound leaves spreading from summit of stem, the inflorescences terminal, erect. Rootstock fleshy. Flowers hermaphrodite or polygamo-dioecious, in terminal usually solitary umbels, the pedicels articulated under flower. Calyx-margin obscurely 5-dentate. Petals 5, very narrowly imbricate and often cohering. Stamens 5, the filaments short, the anthers ovate to oblong. Ovary 2-, sometimes 3-celled. Disk fleshy, annular. Styles 2 or 3, distinct or united at base. Fruit ovoid or laterally compressed, 2- or 3-seeded.

About 5 species in North America and eastern and central Asia.

Type species: *Panax quinquefolius* Linn.

Linnaeus refers three species to the genus *Panax, P. trifoliatus, P. quinquefolius,* and *P. fruticosus.* The first one is an *Acanthopanax* and the last one is the type of the genus *Nothopanax.* Seemann was the first to restrict the genus *Panax* to that type characterized by *Panax quinquefolius* Linn. and he has been followed by Harms and the later workers.

1. **Panax schin-seng** Nees, Ic. Med. Suppl. **1:** *t. 70.* 1833, excl. var. 2 & 3; Nakai, Jour. Arn. Arb. **5:** 35. 1924.

Panax ginseng Meyer, Bull. Phys.-Math. Acad. St. Pétersb. **1:** 340. 1843; Walp. Rep. **5:** 924. 1846; Seem. Jour. Bot. **2:** 320. 1864, **6:** 54. 1868, Revis. Heder. 99. 1868; Harms in Engl. & Prantl. Nat. Pflanzenfam. **3**(8)**:** 59. 1894; Harms ex Diels, Bot. Jahrb. **29:** 490. 1900; Yabe, Enum. Pl. Manch. 98. 1912.

Aralia quinquefolia var. *ginseng* Regel et Maack ex Regel, Gartenfl. **11:** 314. *t. 375.* 1862; Guide to Kew Museum **1:** 87. 1886; Burkill, Kew Bull. **1902:** 6. 1902.

Aralia ginseng Baill. Hist. Pl. **7:** 152. 1880.

Aralia quinquefolia sensu Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 338. 1888, non A. Gray.

This species is found in Manchuria. I have seen only a photograph of a specimen in the Kew Herbarium (Manchuria: Kirin, *V. Komarov 1153,* photo. in NY), no actual specimen being available for study. The distinctions between *Panax schin-seng* Nees and *P. pseudo-ginseng* Wall. are not very clear, the relationships between the two species needing further study on the basis of ample collections. For the time being, I refer all central, western, and southern Chinese plants to the Indian species, *P. pseudo-ginseng* Wall., and its varieties.

Panax schin-seng Nees was illustrated by a colored plate. It includes three varieties, of which two really belong to two distinct species. Following Nakai, the name is used here with the understanding that the first variety is accepted as the type.

Meyer's descriptions of the Asiatic species of *Panax,* as well as reference to Nees' illustrations, are given below.

"Panax Ginseng m.

P. radice simplici palmata; squama ad basin caulis carnosa persistente; foliolis 5 ellipticis sensim acuminatis subaequaliter serratis, serraturis parvis hinc serratura minuta notatis.

Ginseng Jartoux in Lettres édifiant. ed. 1732 vol. 10 p. 159 c. ic. rudi sed haud mala; Du Halde Descr. regn. Chin. ed. germ. II. p. 178 c. ic. (copia figur. supra cit.).—Pan. quinquefolium B. coreense Siebold in Verhandl. d. batav. Genootsch. Vol. 12.—P. Schinseng 1 var. coraiensis Nees ab Esenb. Ic. pl. medicinal. Suppl. I. tab. 16 fig. A (ic. quoad folia haud omnino bona).

Gin-seng, Gen-seng, Gin-sen, Gin-sem, Gin-zing, Jin-chen, Jän-säm, Jän-som, Zin-gin, Schin-schen, Schin-scheng, Schin-sen, Som, Sin-som (chin.).
Nisi, Nisji, Ninzi, Ninzini, Nindsin, Nindzin, Ninsing, Dsindson, Sjusjin (japon.).
Orkoda, Orhota, Orochota (mantsch.).
Soasai (tatar.).
Kitipin Kumunün (mongol., ap. Kamens.).
Hab. in imperii chinensis provincia Mantschiria dicta, nec non in Corea.

Panax Pseudo-Ginseng Wall.

P. radice fasciculata, fibris fusiformibus, rhizomate subrepente; squama ad basin caulis membranacea decidua; foliolis 5 oblongis v. lanceolato-oblongis caudato-acuminatis profunde biserratis, serraturis circumcirca setoso-serrulatis.
P. Pseudo-Ginseng Wallich. plant. asiat. rar. Vol. II, p. 30 tab. 137; Pharmaceut. Centralbl. 1832 No. 23 p. 353 tab. III (copia ic. Wall.).—P. Schin-seng 3 var. nepalensis Nees ab Esenb. l. c. fig. C. (fig. repet. Wall.).

Panax japonicus m.

P. rhizomate repente, fibris lateralibus fusiformibus; squama decidua ad basin caulis; foliolis 5 oblongis acuminatis profunde serratis.
P. quinquefolium A japonicum Siebold l. c.;—P. Schinseng var. 2 japonica Nees ab Esenb. l. c. fig. B.
Plantam non vidi, sed ex icone speciem omnino distinctam esse credo.
Hab. in Japonia."

2. **Panax pseudo-ginseng** Wall. Trans. Med. Phys. Soc. Calcutta **4**: 117. 1829, Pl. Asiat. Rar. **2**: 30. *t. 137.* 1831; Meyer, Bull. Phys.-Math. Acad. St. Pétersb. **1**: 340. 1843; Walp. Rep. **5**: 924. 1846; Seem. Jour. Bot. **6**: 54. 1868, Revis. Heder. 99. 1868; Harms in Engl. & Prantl. Nat. Pflanzenfam. **3**(8): 60. 1894; Hu, Wang & Hsia, Bull. Fan. Mem. Inst. Biol. Bot. **8**: 352. 1938.

Aralia pseudo-ginseng Benth. ex C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 721. 1897.
Aralia quinquefolia var. *pseudo-ginseng* Burkill, Kew Bull. **1902**: 7. 1902.
Aralia quinquefolia var. *notoginseng* Burkill, l. c. syn. nov.
Aralia quinquefolia var. *elantior* Burkill, op. cit. 8, syn. nov.
Panax schin-seng sensu Chien, Contr. Biol. Lab. Sci. Soc. China **3**: 68. 1927; W. W. Smith, Notes Bot. Gard. Edinb. **17**: 318. 1930; Hand.-Maz. Symb. Sin. **7**: 706. 1933; non Nees.

An herb up to 0.5 m. or more high, the rootstock horizontal, fusiform, the stem straight, slender, smooth, the scales at base often fleshy and often deciduous. Leaves 3 or 4 at tip of stem, palmately 5-, rarely 3-foliolate, long-petiolate; petioles slender, glabrous, to 7 cm. long; leaflets sessile to petiolulate, membranaceous, more or less translucent, with abundant or scattered setae along the veins above, sometimes almost glabrous, elliptic-obovate to obovate-lanceolate, 5–15 cm. long, 1–5 cm. wide, the basal ones often smaller and ovate, the apex long-acuminate, the base acute to rounded, the margins inconspicuously serrate to double-serrate, the teeth acute, the lateral nerves about 5–9 on each side, slightly raised on both surfaces, the tertiary veins inconspicuous to subconspicuous; petiolules 0–4.5 cm. long. Inflorescence a terminal, generally solitary umbel, the peduncles slender, straight, up to 20–30 cm. long, the umbels many-flowered; flowers polygamo-monoecious, the pedicels 10–12 mm. long. Calyx glabrous, the margin obscurely 5-dentate. Petals 5, oblong, acute, about 2 mm. long, glabrous. Stamens 5, the filaments 2 mm. long. Ovary 2-celled, the disk flattened or concave, the styles 2, slightly curved. Fruit globose, red, slightly flattened laterally, 6–7 mm. across, 2-seeded, the seeds globose, white, the styles 2, distinct or united halfway below, divergent and reflexed at tip.

Kansu: Gargaunar, south of Old Taichow, *R. C. Ching 899* (W).
Chekiang: Tien Tai Shan, Huating, *C. Y. Chiao UN14466* (W).
Kiangsi: Lu Shan, Kuling, *A. N. Steward UN4695* (LU, W).
Hupeh: No precise locality, *Henry 5396* (G), *5396B* (G), *5396F* (G), *5396H* (W), *6835* (G, W).

Szechuan: No precise locality, *Henry 5396A* (G), *Wilson 1080* (W), *1978* (W), *1979* (W).

Sikang: Chi-na-tung, Tsa-wa-rung, *C. W. Wang 65255* (AA), *65334* (AA); La-jau, Tsa-wa-rung, *C. W. Wang 65832* (AA).

Yunnan: Mengtze, *Henry 11407* (isosyntype of *Aralia quinquefolia* var. *notoginseng* Burkill, NY, W); Szemao, *Henry 11407B* (NY, W), *12259A* (W), *12259B* (NY); Lichiang, *C. Schneider 3011* (G, W), *3617* (G); Yangtze watershed, District of Likiang, eastern slopes of Likiang Snow Range, *J. F. Rock 5752* (W); eastern flank of Lichiang Range, *Forrest 22589* (W); Che-tse-lo, *H. T. Tsai 58337* (AA); Shang-pa Hsien, *H. T. Tsai 54231* (AA), *56563* (AA); Wei-se Hsien, *H. T. Tsai 59743* (AA), *C. W. Wang 63826* (AA), *63975* (AA); Huann-fu-ping, A-tun-tze, *C. W. Wang 69159* (AA); A-tun-tze, *C. W. Wang 69879* (AA), *69904* (AA); Li-kiang Hsien, *C. W. Wang 70729* (AA); Fo-hai, *C. W. Wang 77251* (AA); no data, *T. T. Yü 7461* (AA), *8573* (AA), *12413* (AA); Chungtien, Tungwahlung, Mt. Longchia, *T. T. Yü 13453* (AA); Kengma, Chiuchayko, *T. T. Yü 17278* (AA); Salwin-Kiukiang Newachlung, *T. T. Yü 19290* (AA); Upper Kiukiang Valley, Clulung, Chuherton, *T. T. Yü 19683* (AA); Mekong-Salwin Divide, Sila, *T. T. Yü 22448* (AA); northern flank of the Haba Snow Range, *K. M. Feng 2361* (AA); Litiping, between Likiang and Weihsi, *R. C. Ching 20826* (AA); Ganhai-tze, southwest of Likiang Snow Range, *R. C. Ching 21205* (AA); Likiang Snow Range, *R. C. Ching 30694* (AA).

Kwangsi: Shuen-yuen, *Z. S. Chung 81684* (AA).

Additional distribution: Northern India to Indo-China.

This species is variable in the shape of its leaflets and in the length of its petiolules. The upper surface of the leaflets may be glabrous or sparsely or abundantly setose along the veins. Burkill distinguishes his var. *notoginseng* of China from var. *pseudo-ginseng* of India in that the former has less abundant setae and slightly larger leaflets. He cites *Henry 11407* as representing the former and *Wallich 3730* (in G) the latter, but the actual specimens do not reveal striking differences. *Henry 11407* has fairly abundant setae, in fact more abundant than most of the Chinese specimens secured by subsequent collectors. In both the Indian and Chinese plants, the setae may vary from great abundance to complete absence, while the leaflets are variable in their size and shape and in the length of their petiolules. Thus it seems not desirable to consider the Chinese plants to be distinct from those of India. Burkill described his var. *clantior* from Hupeh, based on Henry's specimens, without mentioning the number. According to his description, this variety falls within the limits of *Panax pseudo-ginseng* Wall. as I here interpret it.

2a. **Panax pseudo-ginseng** var. **angustifolius** (Burkill) comb. nov.

Aralia quinquefolia var. *angustifolia* Burkill, Kew Bull. **1902**: 7. 1902.

Aralia pseudo-ginseng var. *angustifolia* Craib, Fl. Siam. Enum. **1**: 794. 1931.

Leaflets distinctly petiolulate, lanceolate, about 12 cm. long, 1.5–2 cm. wide, the apex long-acuminate, the base rounded to acute or subcordate, the margins minutely serrate, coarsely setose above.

Szechuan: No precise locality, *E. Faber 141* (NY).

Additional distribution: India to Siam.

2b. **Panax pseudo-ginseng** var. **bipinnatifidus** (Seem.) comb. nov.

Panax bipinnatifidus Seem. Jour. Bot. **6**: 54. 1868, Revis. Heder. 100. 1868; Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 60. 1894; Smith, Notes Bot. Gard. Edinb. **14**: 251. 1924; Hand.-Maz. Symb. Sin. **7**: 706. 1933.

Aralia bipinnatifida C. B. Clarke in Hook. f. Fl. Brit. Ind. **2**: 722. 1879.

Leaflets bipinnatifid, the lobes serrate.

Hupeh: No precise locality, *Henry 6834* (G, NY, W).

Szechuan: Muli, *Forrest 21362* (W); Sungpan Hsien, *W. P. Fang 4385* (G, NY, W).

Yunnan: Pin-chuan Hsien, *H. T. Tsai 53649* (AA); Mekong-Salwin divide, Longjrela, *T. T. Yü 23247* (AA).

Additional distribution: Northern India.

Yü 23247 has the leaflets shallowly cleft. *Fang 4385* has leaflets that vary from non-cleft ones to those with few clefts and others which are completely bipinnatifid. They apparently represent intermediate forms between the species and the variety. In this variety, the leaflets also vary from sessile to petiolulate.

2c. **Panax pseudo-ginseng** var. **major** (Burkill) comb. nov.

Aralia quinquefolia var. *major* Burkill, Kew Bull. **1902**: 7. 1902.

Leaflets elliptic to elliptic-ovate, 12–15 cm. long, 5–6 cm. wide, sometimes much larger, the base rounded to obtuse, the margins regularly serrate, with few setae along the veins.

HUPEH: No precise locality, *Henry 5396C* (isosyntype of *Aralia quinquefolia* var. *major* Burkill, W), *5396G* (isosyntype of *Aralia quinquefolia* var. *major* Burkill, AA, G, W), *Henry 7728* (isosyntype of *Aralia quinquefolia* var. *major* Burkill, G, W), *Henry 7121* (NY); south of Wushan, *Wilson 1208* (NY, W).

YUNNAN: Muli, Ngerya, on the border of Chungtien, *K. M. Feng 2792* (AA).

Excluded Species

Panax fallax Miq. Jour. Bot. Néerl. **1**: 118. 1861.

Forbes and Hemsley (Jour. Linn. Soc. Bot. **23**: 339. 1888) mention this as "an obscure imperfectly described plant, perhaps not of this natural order." Merrill (Sunyatsenia **1**: 26. *t. 8.* 1930), on the basis of an examination of the actual type, identifies it as *Peucedanum decursivum* (Miq.) Maxim., an umbelliferous plant, his paper being illustrated by a photographic reproduction of Miquel's type.

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List of cited specimens

In the following list, genera are indicated by these abbreviations: *Ac.* = *Acanthopanax; Ar.* = *Aralia; B.* = *Brassaiopsis; De.* = *Dendropanax; Di.* = *Diplopanax; Hed.* = *Hedera; Het.* = *Heteropanax; K.* = *Kalopanax; Ma.* = *Macropanax; Me.* = *Merrilliopanax; N.* = *Nothopanax; Pa.* = *Panax; Pe.* = *Pentapanax; S.* = *Schefflera; Te.* = *Tetrapanax; Tr.* = *Trevesia; Tu.* = *Tupidanthus.*

Allison, A. 181. *Ac. gracilistylus.*

Arnold Arboretum, cult. 588 = 7029. *Ac. sessiliflorus* var. *parviceps.*

Barchet, S. P. 193. *Ar. chinensis;* 194. *K. pictus;* 197. *Ac. Henryi;* 198. *Hed. nepalensis* var. *sinensis.*

Bailey, L. H. s. n. *Ac. evodiaefolius; K. pictus* var. *magnificus.*

Bock, C. & A. Rosthorn. 2573. *Ac. setchuenensis.*

Bodinier, E. 2459 (*Laborde, J.*). *S. Bodinieri;* 2696 (*Martin, L.*) *B. ciliata.*

Canton Christian College. See Lingnan University.

Cavalerie, J. 871. *N. Delavayi;* 1576. *S. Bodinieri;* 2144. *T. palmata;* 2566. *B. tripteris;* 2658. *S. venulosa.*

Chanet. s. n. *Ar. chinensis* var. *nuda.*

Champion, J. G. s. n. *De. proteus;* 390. *De. parviflorus.*

Chang, Kwei Shang. See Lingnan University.

Chekiang University (Lingnan University Accession numbers). s. n. *De. Chevalieri;* LU77287. *Ac. evodiaefolius;* 77369. *Ar. chinensis;* 77370. *Ar. echinocaulis.*

Chen, F. H. 333. *Ac. sessiliflorus;* 426. *Ac. senticosus.*

Chen, L. 68. *S. octophylla.*

Chen, S. 889. *Hed. nepalensis* var. *sinensis.*

Cheng, W. C. 4146. *Ac. Sieboldianus.*

Cheo, C. C. (University of Nanking number). 18247. *Ac. gracilistylus* var. *pubescens.*

Cheo, T. Y. & L. Yen. 322. *K. pictus* var. *Maximowiczii.*

Chiao, C. Y. (University of Nanking numbers). 1162. *Ac. trifoliatus;* 1806. *Ac. leucorrhizus* var. *fulvescens;* 2052. *Ac. leucorrhizus* var. *scaberulus;* 14297. *Ar. chinensis;* 14381. *Ac. gracilistylus;* 14466. *Pa. pseudo-ginseng;* 14755. *Hed. nepalensis* var. *sinensis;* see also Steward, A. N., C. Y. Chiao, & C. C. Cheo.

Chiao, C. Y. & C. C. Cheo. 807. *De. Chevalieri* var. *dentigerus.*

Chiao, C. Y. & S. C. Fan. 273. *Ac. leucorrhizus* var. *scaberulus;* 310. *Hed. nepalensis* var. *sinensis;* 410. *N. Davidii;* 538. *B. fatsioides;* 717. *Ac. leucorrhizus* var. *scaberulus;* 802. *Ac. leucorrhizus* var. *scaberulus.*

Chien, S. S. 5760. *Ac. trifoliatus.*

Ching, R. C. 377. *Ac. Giraldii* var. *pilosulus;* 887. *Ac. Giraldii* var. *pilosulus;* 899. *Pa. pseudo-ginseng;* 1088. *S. octophylla;* 1300. *Ac. gracilistylus;* 1302. *Hed. nepalensis* var. *sinensis;* 1393. *Ac. gracilistylus;* 1791. *Ac. gracilistylus;* 1871. *Ar. echinocaulis;* 2100. *De. Chevalieri;* 2294. *De. Chevalieri;* 2315. *Ac. evodiaefolius;* 2364. *Ar. chinensis;* 2590. *Ac. trifoliatus;* 2621. *Hed. nepalensis* var. *sinensis;* 2650. *Ac. gracilistylus;* 2705. *Ac. gracilistylus;* 2814. *Ac. evodiaefolius;* 2840. *Ac. gracilistylus;* 2864. *Ac. gracilistylus;* 2937. *De. Chevalieri;* 2957. *Ar. cordata;* 3218. *Ac. evodiaefolius;* 3229. *De. Chevalieri;* 3537. *Ac. trifoliatus;* 4868. *Ar. chinensis;* 4914. *Ac. gracilistylus;* 4996. *Ac. evodiaefolius;* 5045. *Ar. echinocaulis;* 5918. *De. hainanensis;* 5969. *Di. stachyanthus;* 6644. *Ac. trifoliatus;* 6793. *B. glomerulata* var. *longipedicellata;* 6850. *B. gracilis;* 7064. *Ar. armata;* 7115. *Ac. trifoliatus;* 7119. *Ar. echinocaulis;* 7123. *S. minutistellata;* 7151. *Ar. cordata;* 7203. *Hed. nepalensis* var. *sinensis;* 7213. *De. hainanensis;* 7327. *S. venulosa;* 7439. *Ac. trifoliatus;* 7463. *S. glomerulata;* 7680. *Ar. armata;* 7943. *De. parviflorus;* 8019. *De. angustilobus;* 8055. *Hct. chinensis;* 8234. *S. octophylla;* 8306. *De. Chevalieri;* 8350. *S. Metcalfiana;* 8459. *Ar. Decaisneana;* 20481. *Ac. gracilistylus;* 20524. *Ac. evodiaefolius;* 20826. *Pa. pseudo-ginseng;* 21205. *Pa. pseudo-ginseng;* 21439. *S. dumicola;* 21449. *Ac. leucorrhizus;* 21455. *Ar. chinensis* var. *nuda;* 21488. *N. Delavayi;* 21510. *Ac. evodiaefolius;* 21563. *N. Delavayi;* 21574. *Pe. Henryi;* 21598. *N. Delavayi;* 21648. *Pe. Henryi;* 21891. *Hed. nepalensis* var. *sinensis;* 21895. *N. Delavayi;* 22091. *Ac. evodiaefolius;* 22204. *Pe. Henryi;* 30021. *Hed. nepalensis* var. *sinensis;* 30376. *Pe. Leschenaultii;* 30648. *Pe. Leschenaultii;* 30694. *Pa. pseudo-ginseng.*

Ching, R. C. & C. L. Tso. 491. *Ac. Giraldii.*

Chow, H. C. 708. *Ar. chinensis;* 1088. *Ar. chinensis;* 1101. *N. Davidii;* 1341. *N. Davidii;* 1509. *N. Davidii;* 1549. *Ac. trifoliatus;* 1551. *N. Davidii;* 1698. *Ac. trifoliatus;* 1713. *K. pictus;* 1721. *Hed. nepalensis* var. *sinensis;* 1802. *Ac. Giraldii* var. *inermis;* 1956. *S. Delavayi;* 1960. *Hed. nepalensis* var. *sinensis.*

Chun, N. K. 40221. *Ar. Decaisneana;* 41948. *Te. papyrifera;* 42295. *Te. papyrifera;* see also How, F. C. & N. K. Chun.

Chun, N. K. & C. L. Tso. 4007. *Ar. Decaisneana;* 4427. *S. hainanensis;* 43568. *Ar. armata;* 43935. *B. glomerulata;* 44020. *S. octophylla;* 44103. *De. hainanensis;* 44156. *De. hainanensis;* 44635. *Het. fragrans.*

Chun, W. Y. 775. *Ac. trifoliatus;* 2113. *Ac. Giraldii;* 3622. *Ar. chinensis;* 3794. *N. Davidii;* 3847. *N. Davidii;* 3875. *N. Davidii;* 3893. *Ac. setchuenensis;* 3915. *Ac. leucorrhizus;* 3921. *Ac. gracilistylus;* 4020. *Ac. leucorrhizus;* 4038. *Ac. Henryi;* 4044. *K. pictus* var. *magnificus;* 4060. *Ac. evodiaefolius;* 4140. *N. Davidii;* 4192. *N. Davidii;* 4256. *K. pictus;* 4365. *Ac. setchuenensis;* 4389. *K. pictus;* 4429. *N. Davidii;* 5204. *S. octophylla;* 5548. *Ar. Decaisneana;* 5672. *S. Delavayi* var. *ochrascens;* 5714. *Ac. trifoliatus;* 5782. *S. Delavayi* var. *ochrascens;* 5789. *De. confertus;* 5903. *S. octophylla;* 6100. *S. octophylla;* 6952. *N. fruticosus;* 7639. *Ac. trifoliatus.*

Chung, H. H. 1004. *S. octophylla;* 1135. *S. octophylla;* 1289. *S. octophylla;* 2002. *Ac. trifoliatus;* 2135. *Ar. chinensis;* 2417. *Ac. trifoliatus;* 2855. *De. Chevalieri* var. *dentigerus;* 3428. *De. Chevalieri;* 4528. *Ar. Decaisneana;* 4555. *Ac. trifoliatus;* 4824. *Ar. Decaisneana;* 5275. *S. octophylla;* 5900. *Ar. Decaisneana;* 6157. *S. fukienensis;* 6608. *De. Chevalieri* var. *dentigerus;* 7625. *Ac. trifoliatus;* 7831. *Ar. spinifolia;* 8285. *Ar. chinensis.*

Chung, H. H. & S. C. Sun. 528. *Ac. evodiaefolius.*

Chung, Z. S. (*T. S. Tsong*). 81684. *Pa. pseudo-ginseng;* 83301. *Ac. evodiaefolius* var. *gracilis;* 83451. *Ac. evodiaefolius* var. *gracilis;* 83453. *Ac. Chevalieri;* 83497. *Ar. cordata;* 83505. *De. Chevalieri;* 83518. *De. Chevalieri;* 83534. *De. Chevalieri;* 83536. *Ar. echinocaulis;* 83561. *Ac. evodiaefolius;* 83673. *Ac. trifoliatus* var. *setosus.*

Cowdry, N. H. 560. *K. pictus.*

David, O. s. n. *Ac. setulosus.*

Delavay, J. M. s. n. *Pe. yunnanensis;* 2924. *Ar. chinensis* var. *nuda;* 3869. *Pe. Henryi;* 4027. *Ar. Fargesii* var. *yunnanensis.*

Dorsett, P. H. 5984. *Ac. senticosus.*

Dorsett, P. H. & J. H. Dorsett. 3107. *Ac. sessiliflorus;* 4072½. *Ac. senticosus;* 4205. *Ar. elata.*

Ducloux, F. D. 125. *Pe. Henryi;* 169. *Ar. Fargesii.*

Faber, E. 39 = 265. *Ac. trifoliatus;* 44. *K. pictus;* 141. *Pa. pseudo-ginseng* var. *angustifolius;* 158. *N. Davidii;* 1757. *Ac. sessiliflorus.*

Fan, S. C. 53. *N. Davidii.*

Fan, S. C. & Y. Y. Li. 171. *Ac. Sieboldianus;* 203. *Ac. gracilistylus;* 213. *Ac. gracilistylus;* 286. *S. Delavayi;* 307. *Ar. chinensis* var. *nuda;* 341. *De. Chevalieri* var. *dentigerus;* 591. *Ac. trifoliatus;* 604. *K. pictus;* 662. *Hed. nepalensis* var. *sinensis;* 681. *S. Delavayi.*

Fang, W. P. 487. *Ac. trifoliatus;* 2034. *N. Davidii;* 2125. *N. Davidii;* 2247. *Ac. setchuenensis;* 2795. *Ac. leucorrhizus;* 2861. *Ac. leucorrhizus;* 2876. *Ar. chinensis* var. *nuda;* 3106. *N. Davidii;* 3140. *Hed. nepalensis* var. *sinensis;* 3215. *N. Davidii;* 3241. *S. Delavayi;* 3392. *Ac. trifoliatus;* 3436. *Hed. nepalensis* var. *sinensis;* 3523. *Ac. lasiogyne;* 3698. *Ar. chinensis;* 3847. *Ac. trifoliatus;* 4145. *Ac. Giraldii;* 4385. *Pa. pseudo-ginseng* var. *bipinnatifidus;* 4369. *Ar. chinensis* var. *nuda;* 5551. *K. pictus;* 5567. *Te. papyrifera;* 5630. *Hed. nepalensis* var. *sinensis;* 5693. *N. Davidii;* 5717. *Hed. nepalensis* var. *sinensis;* 5740. *S. Bodinieri;* 5785. *Hed. nepalensis* var. *sinensis;* 6691. *Hed. nepalensis* var. *sinensis;* 6692. *Ac. leucorrhizus;* 6713. *Ac. leucorrhizus;* 6723A. *Ac. leucorrhizus;* 7558. *N. Davidii;* 7655. *Ac. leucorrhizus;* 7762. *Ac. leucorrhizus;* 9772. *Ac. trifoliatus;* 12622. *N. Davidii;* 12870. *Ac. leucorrhizus* var. *scaberulus;* 12932. *Ac. leucorrhizus* var. *scaberulus;* 23645. *S. Delavayi.*

Farges, R. P. s. n. *Ar. Fargesii; K. pictus.*

Feng, K. M. 275. *Hed. nepalensis* var. *sinensis;* 565. *Hed. nepalensis* var. *sinensis;* 624. *N. Delavayi;* 1098. *Ac. evodiaefolius;* 1326. *Ar. caesia;* 1330. *Ac. Wilsonii;* 1351. *Ar. apioides;* 1860. *Ac. Wilsonii;* 1939. *N. Delavayi;* 2069. *N. Delavayi;* 2361. *Pa. pseudo-ginseng;* 2423. *N. Delavayi;* 2487. *N. Delavayi;* 2791. *Ar. Fargesii;* 2792. *Pa. pseudo-ginseng* var. *major;* 2881. *Ar. chinensis* var. *nuda;* 2911. *N. Davidii;* 2919. *Pe. Henryi;* 3086. *N. Davidii;* 3089. *K. pictus;* 3111. *S. dumicola;* 3186. *N. Delavayi;* 3215. *Pe. Henryi;* 3279. *S. Hoi;* 3335. *N. Delavayi;* 3342. *Pe. Henryi.*

Fenzel, G. s. n. *Ac. Giraldii;* 715. *Ac. evodiaefolius;* 976. *Hed. nepalensis* var. *sinensis.*

Ford, C. s. n. *De. parviflorus; S. octophylla.*

Forrest, G. s. n. *S. dumicola;* 499. *Hed. nepalensis* var. *sinensis;* 5616. *Ac. evodiaefolius;* 7698. *S. venulosa;* 7704. *Me. Listeri;* 7887. *B. palmipes;* 8086. *Me. Listeri;* 8192. *B. Hainla;* 8267. *Ma. oreophilus;* 8796. *Ma. oreophilus;* 8887. *Ac. evodiaefolius;* 9245. *Hed. nepalensis* var. *sinensis;* 9308. *S. Delavayi;* 9595. *Hed. nepalensis* var. *sinensis;* 9590. *N. Delavayi;* 9670. *B. Hainla;* 9737. *B. Hainla;* 9739. *S. venulosa;* 9790. *S. hypoleucoides;* 10211. *Ac. cissifolius;* 10235. *Ac. evodiaefolius;* 10259. *Ac. Wilsonii;* 10411. *Ac. gracilistylus;* 10676. *N. Delavayi;* 10691. *N. Delavayi;* 10765. *Pe. Leschenaultii;* 10814. *Ar. chinensis* var. *nuda;* 10826. *N. Delavayi;* 10934. *Ar. chinensis* var. *nuda;* 11109. *Pe. Henryi;* 11120. *Pe. Henryi;* 11128. *Pe. Henryi;* 11256. *K. pictus;* 11282. *Ac. evodiaefolius* var. *gracilis;* 11357. *Hed. nepalensis* var. *sinensis;* 11505. *K. pictus;* 11558. *S. venulosa;* 11708. *N. Delavayi;* 11713. *Ac. trifoliatus;* 11748. *Ac. trifoliatus;* 11751. *N. Delavayi;* 11814. *S. shweliensis;* 11822. *Ma. oreophilus;* 11873. *S. venulosa;* 12068. *Ac. evodiaefolius* var. *ferrugineus;* 12848. *B. Hainla;* 13646. *Pe. Leschenaultii;* 13779. *Ac. gracilistylus;* 13854. *Ac. Leschenaultii;* 14881. *S. yunnanensis;* 15922. *Ac. evodiaefolius* var. *ferrugineus;* 16046. *Ac. trifoliatus;* 16215. *N. Delavayi;* 16906. *K. pictus;* 16935. *Pe. Henryi;* 17554. *Ac. trifoliatus;* 17690. *Ma. oreophilus;* 17896. *S. venulosa;* 18077. *Me. Listeri;* 18289. *Ma. oreophilus;* 18503. *Ar. Thomsonii;* 19051. *K. pictus;* 19243. *N. Davidii;* 19419. *Ac. gracilistylus;* 19789. *Ar. chinensis* var. *nuda;* 21362. *Pa. pseudo-ginseng* var. *bipinnatifidus;* 21477. *Ar. chinensis* var. *nuda;* 21574. *Ac. Leschenaultii;* 21624. *S. yunnanensis;* 22163. *Pe. Leschenaultii;* 22328. *S. yunnanensis;* 22859. *Pa. pseudo-ginseng;* 23032. *Pe. Henryi;* 23124. *N. Delavayi;* 24635. *Me. Listeri;* 26172. *B. Hainla;* 26207. *B. Hainla;* 26718. *Pe. subcordatus;* 27186. *S. macrophylla.*

Fung, Hom. See Lingnan University.

Giraldi, J. s. n. *Ac. Henryi; Ac. setchuenensis; Ar. chinensis; Hed. nepalensis* var. *sinensis;* 36. *Ac. brachypus.*

Gressitt, J. L. 1072. *Ar. armata;* 1182. *S. arboricola;* 1498. *Ac. gracilistylus.*

Groff, G. W. See Lingnan University.

Hance, F. 12963. *Ar. Decaisneana.*

Handel-Mazzetti, H. 112 = 10346. *K. pictus;* 132. *De. Chevalieri;* 173. *Hed. nepalensis* var. *sinensis;* 297. *Ac. trifoliatus;* 459. *Te. papyrifera;* 589 p.p. = 11753. *Hed. nepalensis* var. *sinensis;* 589 p.p. *De. parviflorus;* 594 = 11742. *Ac. gracilistylus;* 672 = 12309. *De. Chevalieri*

var. *dentigerus;* 691 = 12254. *Ar. echinocaulis;* 796. *Ac. trifoliatus;* 805 = 12682. *Ar. chinensis;* 806. *Ar. chinensis* var. *dasyphylloides;* 811 = 2629. *K. pictus;* 835 = 12488. *Ac. Simonii;* 839 = 12407. *De. Chevalieri* var. *dentigerus;* 2066. *Ar. Wilsonii;* 2542. *S. Delavayi;* 4381. *Ar. chinensis* var. *nuda;* 4410. *Ar. caesia;* 4456. *N. Delavayi;* 5639. *Ac. trifoliatus;* 6047. *S. venulosa;* 6424. *Pe. yunnanensis;* 6445. *Ac. Wilsonii;* 6840. *K. pictus;* 7540. *Hed. nepalensis* var. *sinensis;* 7865. *Ac. leucorrhizus* var. *fulvescens;* 7875. *Pe. Henryi;* 7973. *Ac. Wardii;* 8303. *Me. Listeri;* 8321. *Pe. Leschenaultii* var. *Forrestii;* 8409. *N. Davidii;* 8888. *Ac. cissifolius;* 9833. *S. yunnanensis;* 10009. *Ar. chinensis* var. *nuda;* 10015. *K. pictus.*

Henry, A. s. n. *Het. fragrans;* 1258. *Hed. nepalensis* var. *sinensis;* 1735. *S. octophylla;* 2104. *Ar. chinensis;* 2246. *K. pictus;* 2246A. *K. pictus;* 2253. *Ac. trifoliatus;* 2253A. *Ac. trifoliatus;* 2534. *N. Davidii;* 2535. *Ar. chinensis;* 2573. *Ac. leucorrhizus;* 2580. *Ac. leucorrhizus;* 2639. *Ac. trifoliatus;* 2762. *Ac. trifoliatus;* 2967. *N. Davidii;* 2984. *Hed. nepalensis* var. *sinensis;* 3101. *K. pictus;* 3261. *Hed. nepalensis* var. *sinensis;* 3341. *Hed. nepalensis* var. *sinensis;* 3406. *Ac. gracilistylus;* 3406A. *Ac. gracilistylus;* 4337. *N. Davidii;* 4337A. *N. Davidii;* 4573. *K. pictus;* 4832. *Ac. Henryi;* 5396. *Pa. pseudo-ginseng;* 5396A. *Pa. pseudo-ginseng;* 5396B. *Pa. pseudo-ginseng;* 5396C. *Pa. pseudo-ginseng* var. *major;* 5396F. *Pa. pseudo-ginseng;* 5396G. *Pa. pseudo-ginseng* var. *major;* 5396H. *Pa. pseudo-ginseng;* 5890. *Ac. gracilistylus* var. *villosulus;* 5930. *Ac. Rehderianus;* 5950B. *Ac. setchuenensis;* 5950C. *Ac. leucorrhizus* var. *scaberulus;* 5950E. *Ac. leucorrhizus* var. *scaberulus;* 6503. *Ac. Simonii;* 6503A. *Ac. Simonii;* 6503B. *Ac. leucorrhizus* var. *scaberulus;* 6521. *Ac. setchuenensis;* 6608A. *N. Davidii;* 6608B. *N. Davidii;* 6630. *Ac. setchuenensis;* 6655. *Ar. Henryi;* 6785. *Ar. Fargesii;* 6834. *Pa. pseudo-ginseng* var. *bipinnatifidus;* 6835. *Pa. pseudo-ginseng;* 6891. *Ac. Giraldii;* 7035. *Pe. Henryi;* 7121. *Pa. pseudo-ginseng* var. *major;* 7498. *N. Davidii;* 7609. *Ac. Henryi;* 7728. *Pa. pseudo-ginseng* var. *major;* 7909. *Ac. leucorrhizus;* 9180. *B. ciliata;* 9180A. *B. ciliata;* 9214. *S. Delavayi;* 9214B. *S. Delavayi;* 9284. *Pe. verticillatus;* 9403. *S. venulosa;* 9403B. *S. venulosa;* 9403C. *S. venulosa;* 9479 p.p. *Ar. Decaisneana;* 9479 p.p. *Ar. chinensis* var. *nuda;* 9479A. *Ar. Decaisneana;* 9479B. *Ar. Decaisneana;* 9479C. *Ar. chinensis* var. *nuda;* 9530. *S. producta;* 9564. *S. hypoleuca;* 9654A. *B. glomerulata;* 9723. *S. Hoi;* 9806. *Pe. Leschenaultii;* 9856. *Hed. nepalensis* var. *sinensis;* 9856A. *Hed. nepalensis* var. *sinensis;* 9927. *N. Delavayi;* 9927B. *N. Delavayi;* 9927C. *Pe. Delavayi;* 9927D. *Pe. Delavayi;* 10158. *Ac. trifoliatus* var. *setosus;* 10158A. *Ac. trifoliatus* var. *setosus;* 10541. *S. venulosa;* 10639. *Ac. gracilistylus;* 10622. *Ar. caesia;* 11158. *Ac. trifoliatus* var. *setosus;* 11244. *Ar. caesia;* 11271. *Ar. foliolosa;* 11278. *Pe. Henryi;* 11278A. *Pe. Henryi;* 11382 p.p. *S. producta;* 11382 p.p. *S. hypoleuca;* 11407. *Pa. pseudo-ginseng;* 11407B. *Pa. pseudo-ginseng;* 11435. *S. hypoleucoides;* 11492. *B. glomerulata;* 11650. *B. ficifolia;* 11757. *Tr. palmata;* 11764. *Ma. undulatus* var. *simplex;* 11840. *S. hypoleuca;* 11882. *B. Hainla;* 12259A. *Pa. pseudo-ginseng;* 12259B. *Pa. pseudo-ginseng;* 12298. *Tu. calyptratus;* 12298A. *Tu. calyptratus;* 12298B. *Tu. calyptratus;* 12402. *Ma. undulatus* var. *simplex;* 12561. *Ac. trifoliatus;* 12644. *Ma. undulatus* var. *simplex;* 12653. *B. ficifolia;* 12653A. *B. ficifolia;* 12653B. *B. ficifolia;* 12770. *Ac. trifoliatus* var. *setosus;* 12801. *S. octophylla;* 12865. *Het. chinensis;* 12939. *S. chinensis;* 13044. *S. venulosa;* 13082. *Ma. oreophilus;* 13083. *Ma. oreophilus;* 13083A. *Ma. oreophilus;* 13294. *B. Hainla;* 13301. *S. hypoleucoides;* 13304. *Hed. nepalensis* var. *sinensis;* 13409. *S. macrophylla;* 13409A. *S. macrophylla;* 13426. *S. Searelliana;* 13456. *B. glomerulata;* 13462. *S. Hoi;* 13474. *S. elata;* 13621. *B. glomerulata.*

Hers, J. H. 948. *Ar. chinensis;* 1151. *Ar. chinensis* var. *nuda;* 1271. *Ar. chinensis;* 2274. *Ar. chinensis;* 2428. *Ar. chinensis.*

Ho, H. T. 60146. *Ar. Decaisneana.*

Hongkong Botanical Garden, Herbarium of. 924. *De. proteus;* 2760. *Hed. nepalensis* var. *sinensis;* 10198. *De. proteus.*

How, F. C. 72313. *B. glomerulata;* 72765. *S. arboricola;* 73107. *B. glomerulata;* 73229. *S. arboricola;* 73522. *B. glomerulata;* 73528. *De. oligodontus;* 73535. *S. arboricola;* 73623. *De. Chevalieri;* 73958. *Ar. Decaisneana.*

How, F. C. & N. K. Chun. 70103. *S. octophylla.*

Hsia, W. Y. See Tang, T. & W. Y. Hsia.

Hu, H. H. 185. *S. octophylla;* 235. *Ar. chinensis;* 253. *K. pictus* var. *magnificus;* 331. *De. Chevalieri;* 508. *Ac. trifoliatus;* 534. *Hed. nepalensis* var. *sinensis;* 1238. *De. Chevalieri;* 1249. *De. Chevalieri;* 1265. *De. Chevalieri* var. *dentigerus;* 1646. *Ac. evodiaefolius;* 2365. *Ac. evodiaefolius.*

Hwang, C. Y. 64. *N. Davidii.*

Ip, N. K. (University of Nanking numbers). 4781. *De. Chevalieri;* 4783. *Ac. Sieboldianus.*

James, H. E. M. s. n. *Ac. senticosus.*

Keng, Y. L. 54. *Ar. chinensis;* 353. *Ac. evodiaefolius;* 451. *Ar. echinocaulis;* 930. *De. Chevalieri* var. *dentigerus;* 1204. *De. Chevalieri* var. *dentigerus;* 1063. *Ac. evodiaefolius;* 1064. *Ac. gracilistylus;* 1067. *K. pictus;* 1118. *Ac. gracilistylus;* 1956. *K. pictus;* 2635. *Ar. chinensis;* 2691. *Ac. gracilistylus.*

King, T. F. 520. *Ac. Henryi.*

Ko, S. P. 50164. *De. Chevalieri;* 51164. *S. minutistellata;* 51780. *Ac. phanerophlebius;* 52789. *Ac. gracilistylus* var. *nodiflorus;* 55386. *Ma. undulatus;* 55841. *S. octophylla.*

Komarov, V. 149. *Ac. senticosus;* 1148. *Ac. sessiliflorus;* 1151. *Ar. elata;* 1152. *Ar. cordata.*

Korshinsky, S. s. n. *Ac. senticosus.*

Kung, H. W. 1896. *Ac. senticosus;* 2087. *Ac. sessiliflorus.*

Kuntze, Otto. 3575. *S. octophylla.*

Laborde, J. See Bodinier, E.

Lau, S. K. 350. *S. arboricola;* 638. *Ac. trifoliatus;* 672. *S. octophylla;* 756. *Ar. Decaisneana;* 957. *De. parviflorus;* 1241. *Het. fragrans;* 1888. *B. glomerulata;* 2011. *S. octophylla;* 2012. *De. parviflorus;* 2050. *Ac. trifoliatus;* 2232. *Ar. dasyphylla;* 2262. *S. octophylla;* 2325. *De. parviflorus;* 2415. *De. Chevalieri* var. *dentigerus;* 2426. *Het. brevipedicellatus;* 2436. *Ar. spinifolia;* 2642. *Hed. nepalensis* var. *sinensis;* 2741. *De. Chevalieri;* 2980. *Het. fragrans;* 3216. *S. octophylla;* 3419. *Het. fragrans;* 3869. *B. glomerulata;* 3949. *De. Chevalieri* var. *dentigerus;* 4218. *Ac. trifoliatus;* 4224. *Ar. chinensis* var. *dasyphylloides;* 4363. *Ar. chinensis* var. *dasyphylloides;* 4380. *Ar. spinifolia;* 4404. *Het. brevipedicellatus;* 4428. *De. Chevalieri* var. *dentigerus;* 4567. *Ar. spinifolia;* 4593. *Ac. trifoliatus;* 4756. *Ar. Decaisneana;* 4847. *S. Delavayi* var. *ochrascens;* 4876. *Het. fragrans* var. *subcordatus;* 4994. *Ar. Decaisneana;* 4998. *B. glomerulata;* 25479. *B. glomerulata;* 27343. *De. hainanensis;* 28169. *De. oligodontus;* 28337. *De. oligodontus;* 28381. *S. octophylla;* 28693. *B. glomerulata* var. *longipedicellata;* 28812. *De. inflatus.*

Lei, C. I. 187. *S. arboricola;* 221. *S. octophylla;* 284. *Het. fragrans* var. *attenuatus;* 357. *S. octophylla;* 930. *Ar. armata.*

Levine, C. O. See Lingnan University.

Levine, C. O. & G. W. Groff. See Lingnan University.

Levine, C. O. & F. A. McClure. See Lingnan University.

Li, C. F. 10046. *K. pictus;* 10058. *Ar. chinensis;* 10098. *Ac. sessiliflorus;* 11234. *Ac. senticosus.*

Li, M. K. 2189. *S. shweliensis.*

Li, Y. Y. See Fan, S. C. & Y. Y. Li.

Liang, H. Y. 60149. *De. hainanensis;* 60946. *Ac. gracilistylus;* 62558. *B. glomerulata;* 62613. *B. glomerulata;* 63075. *S. arboricola;* 63389. *Ar. Decaisneana;* 63429. *Het. fragrans;* 63435. *S. arboricola;* 63484. *S. octophylla;* 63650. *Het. fragrans;* 63681. *S. octophylla;* 63839. *Het. fragrans;* 64812. *Ma. oreophilus;* 64336. *S. octophylla;* 64627. *Ar. Decaisneana;* 66310. *Het. fragrans;* 66429. *Het. fragrans;* 69974. *Ac. trifoliatus* var. *setosus.*

Licent, L. 12209. *Ac. senticosus* f. *inermis;* 12668. *Ac. Giraldii* var. *inermis.*

Ling, K. (University of Nanking numbers). 12295. *Ac. Giraldii;* 12553. *Ac. Giraldii.*

Lingnan University (formerly Canton Christian College; numbers below 9576 are marked CCC, numbers above 12523 are marked LU).[1] 117 (*Levine & Groff*). *S. octophylla;* 182 (*Levine*). *Ac. trifoliatus;* 262 (*Levine*). *S. octophylla;* 369 (*Levine*). *S. octophylla;* 418 (*Levine*). *Ar. Decaisneana;* 558 (*Levine*). *Ac. trifoliatus;* 1235 (*Levine*). *De. acuminatissimus;* 1315 (*Levine*). *De. acuminatissimus;* 1376 (*Levine*). *De. Chevalieri;* 1433 (*Levine*). *De. Chevalieri;* 1525 (*Levine*). *De. Chevalieri;* 1684 (*Levine*). *S. octophylla;* 1702 (*Levine*). *Ar. Decaisneana;* 1851 (*Levine*). *Ar. chinensis* var. *nuda;* 1853 (*Levine*). *Ar. Decaisneana;* 2739 (*To Kang-peng*). *Het. fragrans;* 3242 (*Levine*). *Ar. spinifolia;* 3400 (*Levine*). *S. octophylla;* 6841 (*Levine & McClure*). *De. Chevalieri;* 7544 (*McClure*). *Ac. trifoliatus;* 7894 (*McClure*). *S. octophylla;* 8044 (*McClure 1350*). *Ar. Decaisneana;* 8474 (*McClure*). *Ar. armata;* 8732 (*W. T. Tsang*). *Hed. nepalensis* var. *sinensis;* 9434 (*McClure 8878*). *B. glomerulata;* 9576A (*McClure*). *S. arboricola;* 9576B (*McClure*). *S. arboricola;* 12523 (*To & Tsang*). *De. Chevalieri;* 13085 (*McClure*). *Ac. trifoliatus;* 13773 (*McClure*). *S. Delavayi* var. *ochrascens;* 14181 (*W. T. Tsang & K. C. Wang*). *Ar. dasyphylla;* 14841 (*W. T. Tsang & K. C. Wang*). *Te. papyrifera;* 14996 (*W. T. Tsang & K. C. Wang*). *K. pictus;* 15346 (*McClure 3996*). *K. pictus;* 16179 (*W. T. Tsang 680*). *Ar. armata;* 16267 (*W. T. Tsang 768*). *S. octophylla;* 16294 (*W. T. Tsang 795*). *S. arboricola;* 16307 (*W. T. Tsang 808*). *S. octophylla;*

[1] For an explanation of the numbers of the Lingnan University specimens and those of several other Chinese herbaria, see Metcalf, Fl. Fukien **1**: 5. 1942.

16324 (*W. T. Tsang 825*). *Ar. armata;* 16532 (*W. T. Tsang*). *S. octophylla;* 16588 (*W. T. Tsang*). *S. octophylla;* 17677 (*Tsang, Tang, & Fung 146*). *Ma. oreophilus;* 17837 (*Tsang, Tang, & Fung 303*). *Ma. oreophilus;* 18174 (*Tsang & Fung 640*). *B. glomerulata;* 18219 (*Tsang & Fung 685*). *Ar. armata;* 18592 (*McClure Y124*). *S. kwangsiensis?;* 18627 (*Fung Hom*). *Het. fragrans;* 19098 (*McClure*). *Ar. spinifolia;* 19126 (*Tang Sui Pan 6*). *Ar. Decaisneana;* 19147 (*Tang Sui Pan & Fung Hom 27*). *S. octophylla;* 19235 (*McClure B64*). *Hed. helix;* 19422 (*Fung Hom*). *De. Chevalieri;* 19474 (*Fung Hom*). *De. proteus;* see also Chekiang University.

Liou, T. N. 183. *Ac. evodiaefolius;* 263. *Ac. Henryi* var. *Faberi.*

Litvinov, D. s. n. *Ac. sessiliflorus.*

Liu, J. C. 1481. *Ac. senticosus.*

Liu, J. C. & B. E. Read. L2012 = R563. *Ac. sessiliflorus.*

Liu, Y. S. 1107. *N. Davidii;* 1164. *Ac. leucorrhizus* var. *fulvescens;* 1190. *Ac. leucorrhizus;* 1272. *Ac. leucorrhizus* var. *fulvescens;* 1431. *Hed. nepalensis* var. *sinensis;* 1483A. *Ar. chinensis;* 1616. *Ac. leucorrhizus* var. *fulvescens;* 1726. *B. ciliata;* 1864. *S. Delavayi;* 1916. *K. pictus;* 2033. *Ac. trifoliatus;* 2194. *Ac. evodiaefolius;* 2246. *Ac. leucorrhizus;* 2248. *Ac. leucorrhizus;* 2262. *Te. papyrifera.*

Maack, R. s. n. *Ac. sessiliflorus; Ar. elata.*

MacGregor, D. s. n. *Ac. gracilistylus; Hed. nepalensis* var. *sinensis;* 30. *Hed. nepalensis* var. *sinensis.*

Maire, E. E. s. n. *Te. papyrifera;* 450. *Ac. Giraldii;* 2918. *Ac. trifoliatus;* 2988. *Ac. trifoliatus;* 6300. *Pe. yunnanensis;* 6815. *Ar. chinensis* var. *nuda;* 7369. *Ar. chinensis* var. *nuda;* 7463. *Ac. Giraldii.*

Maire, R. P. 6816. *Ar. chinensis* var. *nuda.*

Martin, L. See Bodinier, E.

Maximowicz, C. J. s. n. *Ac. sessiliflorus; Ar. cordata; Ar. elata; K. pictus.*

McClure, F. A. 20125. *Ma. oreophilus;* see also Lingnan University.

Merrill, E. D. 10057. *Ac. trifoliatus;* 10187. *De. acuminatus;* 10327. *De. proteus;* 11035. *De. Chevalieri.*

Metcalf, F. P. 17627. *Hed. nepalensis* var. *sinensis.*

Meyer, F. N. 1365. *Ac. senticosus;* 1369. *Ac. senticosus;* 1473. *Ac. gracilistylus;* 1530. *De. Chevalieri* var. *dentigerus;* 1556. *K. pictus* var. *magnificus;* 1569. *Ar. echinocaulis;* 1769. *Ac. leucorrhizus;* 2007. *Hed. nepalensis* var. *sinensis.*

Nanking, University of. See Cheo, C. C., Chiao, C. Y., Ip, N. K., Ling, K., & Steward, A. N.

Norton, J. B. 1362. *Ar. chinensis;* 1363. *De. Chevalieri;* 1435. *Hed. nepalensis* var. *sinensis.*

Peng, T. C. 184. *Ar. chinensis.*

Pratt, A. E. 789. *Hed. nepalensis* var. *sinensis.*

Purdom, W. s. n. *Ac. Giraldii* var. *pilosulus;* 1. *Ar. chinensis* var. *nuda;* 2. *Ac. setchuenensis;* 3. *Ac. Giraldii;* 4. *Ac. stenophyllus;* 7. *Ac. Giraldii;* 350. *Ac. gracilistylus;* 445. *Ac. Giraldii;* 1011. *Hed. nepalensis* var. *sinensis.*

Read, B. E. See Liu, J. C. and B. E. Read.

Rock, J. F. 2356. *Het. fragrans;* 2395. *Tr. palmata;* 2402. *Tr. palmata;* 2417. *Ar. Thomsonii;* 2472. *Ma. undulatus* var. *simplex;* 2556. *Het. fragrans* var. *attenuatus;* 2655. *Ar. armata;* 2757. *Tu. calyptratus;* 2863. *S. venulosa;* 2866. *S. venulosa;* 2928. *B. Hainla;* 2949. *Tr. palmata;* 3523. *Hed. nepalensis* var. *sinensis;* 3730. *Pe. Leschenaultii;* 3771. *Ac. Wilsonii;* 3953. *Ar. Wilsonii;* 4133. *Ac. evodiaefolius;* 4204. *Ac. evodiaefolius;* 4482. *Pe. Leschenaultii;* 4866. *Ac. Wilsonii;* 5083. *Ar. Wilsonii;* 5106. *Ac. evodiaefolius;* 5192. *Ac. evodiaefolius;* 5752. *Pa. pseudo-ginseng;* 5756. *Hed. nepalensis* var. *sinensis;* 6203. *N. Delavayi;* 6564. *Pe. Henryi;* 6951. *N. Delavayi;* 6969. *Ac. trifoliatus;* 7016. *Me. Listeri;* 7018. *S. shweliensis;* 7096. *S. Delavayi;* 7232. *S. venulosa;* 7278. *S. minutistellata;* 7364. *Ma. undulatus;* 7411. *S. impressa;* 7433. *Ma. undulatus;* 7570. *Ac. trifoliatus;* 7586. *S. Delavayi;* 7626. *Hed. nepalensis* var. *sinensis;* 7632. *S. impressa;* 7639. *S. shweliensis;* 7851. *S. venulosa;* 8302. *Pe. Leschenaultii;* 8544. *Ar. Wilsonii;* 8984. *Ac. Wilsonii;* 9407. *Ac. gracilistylus;* 9512. *Ac. evodiaefolius;* 10244. *Me. Listeri;* 10363. *Ac. evodiaefolius;* 10365. *Ac. Wardii;* 10408. *Ar. chinensis* var. *nuda;* 10571. *N. Delavayi;* 11521. *K. pictus;* 11553. *Ac. leucorrhizus;* 11614. *K. pictus;* 11632. *S. Hoi;* 11633. *N. Delavayi;* 11651. *Ac. evodiaefolius;* 12063. *Hed. nepalensis* var. *sinensis;* 12657. *Ac. Giraldii* var. *pilosulus;* 12695. *Ac. Giraldii;* 12845. *Ac. Giraldii;* 13106. *Ac. Giraldii* var. *pilosulus;* 13215. *Ar. chinensis* var. *nuda;* 13481. *Ar. chinensis* var. *nuda;* 13491. *Ac. Giraldii;* 13534. *Ac. Giraldii;* 13665. *Ac. leucorrhizus;* 14572. *Ar. chinensis* var. *nuda;* 14669. *Ac. leucorrhizus;* 14673. *Ar. chinensis* var. *nuda;* 14721. *Ac. leucorrhizus;* 14764.

Ac. Giraldii; 14811. *Ac. Giraldii;* 14825. *Ar. chinensis* var. *nuda;* 14850. *Ac. stenophyllus* var. *angustissimus;* 14866. *Ac. Giraldii;* 14893. *Ac. Giraldii;* 15023. *Ac. leucorrhizus;* 15085. *Ar. chinensis* var. *nuda;* 16900. *Ar. Wilsonii;* 17820. *Ar. Wilsonii;* 18051. *Ac. evodiaefolius;* 18270. *Hed. nepalensis* var. *sinensis;* 22283. *Ac. evodiaefolius* var. *ferrugineus;* 22652. *Ac. evodiaefolius;* 23869. *Ac. evodiaefolius;* 24394. *Ac. evodiaefolius;* 24712. *Ac. Wilsonii;* 25404. *Ac. evodiaefolius.*

Sargent, C. S. s. n. *Ac. senticosus; Het. fragrans; S. octophylla.*

Schoh, O. 67 = 408. *K. pictus;* 325. *N. Delavayi.*

Schneider, C. s. n. *Ac. Simonii;* 156. *Hed. nepalensis* var. *sinensis;* 320. *Hed. nepalensis* var. *sinensis;* 395. *N. Delavayi;* 409. *Hed. nepalensis* var. *sinensis;* 1220. *Ar. Wilsonii;* 1221. *Ar. Wilsonii;* 1417. *S. dumicola;* 1427. *Ac. evodiaefolius* var. *gracilis;* 2075. *Pe. Henryi;* 2236. *N. Delavayi;* 2387. *Ac. cissifolius;* 2441. *Pe. Leschenaultii;* 2471. *Ac. evodiaefolius;* 2793. *Ac. trifoliatus;* 3011. *Pa. pseudo-ginseng;* 3059. *Hed. nepalensis* var. *sinensis;* 3166. *Pe. Leschenaultii;* 3267. *Hed. nepalensis* var. *sinensis;* 3288. *Ac. evodiaefolius;* 3617. *Pa. pseudo-ginseng;* 3891. *Ar. Wilsonii;* 4054. *S. Delavayi.*

Schrank, L. s. n. *Ac. senticosus.*

Shangtung University. 1037. *Ar. chinensis.*

Shearer, G. s. n. *K. pictus.*

Sin, S. S. 9569. *Ar. echinocaulis;* 11020. *De. parviflorus;* 11346. *De. confertus;* 11458. *Ar. spinifolia;* 11517. *Ar. dasyphylla;* 11742. *De. confertus.*

Skvortzov, B. V. s. n. *Ac. sessiliflorus; Ar. elata.*

Smith, H. 303. *Ac. sessiliflorus;* 306. *Ac. senticosus;* 758. *Ac. sessiliflorus;* 912. *Ac. senticosus* f. *subinermis;* 2831. *Ac. Giraldii;* 3641. *Ac. Giraldii;* 4536. *Ac. Wardii;* 4753. *Ac. Wardii;* 4858. *Hed. nepalensis* var. *sinensis;* 6484. *Ac. senticosus* f. *inermis;* 6563. *Ac. stenophyllus* var. *dilatatus;* 7783. *Ac. senticosus.*

Steward, A. N. (University of Nanking numbers). 2039. *K. pictus;* 2116. *Ac. gracilistylus;* 2568. *K. pictus;* 2752. *K. pictus;* 2783. *K. pictus;* 4224. *Ac. leucorrhizus* var. *scaberulus;* 4695. *Pa. pseudo-ginseng;* 4753. *Ar. chinensis;* 7141. *De. Chevalieri;* 9773. *Ar. chinensis;* 14707. *K. pictus;* 14709. *K. pictus;* 14477. *K. pictus;* 18931. *K. pictus.*

Steward, A. N. & C. C. Cheo. 11. *S. Bodinieri;* 402. *B. ciliata;* 776. *S. Delavayi;* 976. *Ar. undulata;* 1039. *Ar. armata;* 1054. *De. stellatus;* 1086. *S. octophylla;* 1200. *Te. papyrifera.*

Steward, A. N., C. Y. Chiao, & C. C. Cheo. 126. *Ac. trifoliatus;* 258. *Ac. gracilistylus;* 262. *N. Delavayi;* 374. *De. hainanensis;* 478. *Ac. evodiaefolius;* 505. *Ac. setchuenensis;* 566. *Ac. trifoliatus;* 694. *Hed. nepalensis* var. *sinensis;* 725. *S. Bodinieri;* 740. *Te. papyrifera;* 758. *S. Bodinieri;* 829. *Ar. dasyphylla;* 917. *N. Davidii.*

Sun, S. C. 1303. *Ar. chinensis;* 1466. *Ac. evodiaefolius;* see also Chung, H. H. & S. C. Sun.

Sylvestri, C. s. n. *Ar. chinensis* var. *nuda;* 1598. *Ac. gracilistylus* var. *pubescens;* 1600. *Ac. gracilistylus* var. *pubescens;* 1601. *K. pictus;* 1613. *Hed. nepalensis* var. *sinensis.*

Taam, Y. W. 123. *De. acuminatissimus;* 283. *De. parviflorus.*

Tang, Siu Ging. 5560. *Ac. trifoliatus;* 5820. *Ac. trifoliatus;* 6765. *Hed. nepalensis* var. *sinensis;* 6831. *S. octophylla;* 6967. *S. octophylla;* 7068. *Ac. trifoliatus;* 13008. *S. octophylla;* 13105. *S. octophylla;* 13270. *S. octophylla.*

Tang, Sui Pan. See Lingnan University.

Tang, Sui Pan & Fung Hom. See Lingnan University.

Tang, T. 982. *Ac. senticosus;* 1481. *Ac. senticosus.*

Tang, T. & W. Y. Hsia. 156. *Ar. chinensis.*

Ten, P. S. 600. *Hed. nepalensis* var. *sinensis.*

Ten, Simeon. 32. *N. Delavayi;* 468. *Ac. evodiaefolius;* 508. *Ac. evodiaefolius;* 533. *Ar. chinensis* var. *nuda;* 537. *N. Delavayi.*

Teng, S. W. 90353. *Ac. gracilistylus;* 90684. *Ar. chinensis;* 90787. *Ac. trifoliatus;* 90830. *S. glomerulata;* 90890. *Ar. armata;* 90995. *B. glomerulata* var. *longipedicellata.*

To, Kang-Peng. See Lingnan University.

To, Kang-Peng & W. T. Tsang. See Lingnan University.

Tsai, H. T. 50263. *Ac. senticosus;* 50277. *Ar. cordata;* 50522. *Ar. chinensis* var. *nuda;* 51246. *Ac. evodiaefolius;* 51291. *Ac. leucorrhizus* var. *fulvescens;* 51423. *B. fatsioides;* 51443. *S. minutistellata;* 51489. *S. Delavayi;* 51505. *S. hypoleucoides;* 51538A. *S. hypoleucoides;* 51890. *B. ciliata;* 52450. *S. diversifoliolata;* 52466. *S. hypoleucoides;* 52642. *S. Searelliana;* 52740. *Ac. Simonii;* 52042. *N. Delavayi;* 52982. *Pe. Leschenaultii;* 53121. *S. venulosa;* 53252. *S. venulosa;* 53649. *Pa. pseudo-ginseng* var. *bipinnatifidus;* 54028. *N. Delavayi;* 54075. *S. dumicola;* 54085. *Hed. nepalensis* var. *sinensis;* 54121. *S. impressa;* 54231. *Pa. pseudo-ginseng;*

54353. *Me. Listeri;* 54378. *S. Hoi;* 54386. *Me. Listeri;* 54451. *S. Hoi;* 54453. *Ac. evodiaefolius;* 54478. *S. impressa;* 54518. *S. shweliensis;* 54526. *S. Delavayi;* 54588. *Ma. oreophilus;* 54759. *B. glomerulata* var. *coriacea;* 54950. *Me. Listeri;* 54951. *B. hispida;* 54969. *S. Delavayi;* 54978. *S. Hoi;* 55034. *S. venulosa;* 55347. *S. glomerulata;* 55495. *B. glomerulata* var. *coriacea;* 55510. *B. Hainla;* 55894. *S. khasiana;* 56119. *Hed. nepalensis* var. *sinensis;* 56134. *N. Delavayi;* 56278. *N. Delavayi;* 56305. *B. Hainla;* 56307. *B. fatsioides;* 56386. *B. chengkangensis;* 56505. *Ac. evodiaefolius;* 56550. *S. Hoi;* 56557. *Me. Listeri;* 56563. *Pa. pseudo-ginseng;* 56575. *B. palmipes;* 56580. *Ar. chinensis;* 56583A. *Me. Listeri;* 56628. *S. macrophylla;* 56823. *Ma. undulatus;* 56855. *Ma. undulatus* var. *simplex;* 56890. *B. Hainla;* 57212. *Ac. evodiaefolius;* 57283. *Ar. Wilsonii;* 57355. *Ar. chinensis* var. *nuda;* 57357. *Ar. Wilsonii;* 57366. *Ac. leucorrhizus* var. *fulvescens;* 57450. *Ar. chinensis* var. *nuda;* 57524. *N. Delavayi;* 57665. *Ar. chinensis* var. *nuda;* 57797. *Ac. leucorrhizus;* 57816. *Hed. nepalensis* var. *sinensis;* 57841. *Ac. evodiaefolius;* 57868. *Hed. nepalensis* var. *sinensis;* 57886. *Ar. chinensis* var. *nuda;* 57912. *Ac. leucorrhizus;* 57929. *Ac. leucorrhizus;* 57939. *Ac. leucorrhizus;* 58091. *Ac. evodiaefolius;* 58337. *Pa. pseudo-ginseng;* 58347. *S. multinervia;* 58363. *S. impressa;* 58512A. *Ac. trifoliatus;* 58678. *De. Chevalieri;* 58728. *De. Chevalieri;* 58861. *Ar. chinensis;* 58864. *Me. Listeri;* 58890. *Hed. nepalensis* var. *sinensis;* 58923. *Ac. trifoliatus;* 58926. *Ac. trifoliatus;* 59035. *S. Hoi;* 59086. *B. glomerulata* var. *coriacea;* 59089. *S. chinensis;* 59338. *Pe. Leschenaultii;* 59587. *Ac. evodiaefolius;* 59589. *S. Hoi;* 59594. *Hed. nepalensis* var. *sinensis;* 59693. *Ac. evodiaefolius;* 59743. *Pa. pseudo-ginseng;* 59759. *Ac. evodiaefolius;* 59765. *Ar. chinensis* var. *nuda;* 59841. *Ac. evodiaefolius;* 59847. *Hed. nepalensis* var. *sinensis;* 59919. *Hed. nepalensis* var. *sinensis;* 59960. *Ac. evodiaefolius;* 60006. *S. venulosa;* 60278. *S. glomerulata;* 60332. *B. glomerulata* var. *coriacea;* 60342. *S. glomerulata;* 61147. *B. glomerulata* var. *coriacea;* 61564. *De. Chevalieri;* 61624. *De. Chevalieri;* 61693. *S. Hoi;* 61854. *Ar. armata;* 61908. *Ac. trifoliatus* var. *setosus;* 62236. *B. glomerulata;* 62457. *N. Davidii;* 62493. *N. Davidii;* 62632. *N. Davidii;* 62779. *S. hainensis;* 62881. *N. Davidii.*

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III

A REVISION OF THE GENUS SABIA COLEBROOKE

BY

LUETTA CHEN

WITH NINE TEXT-FIGURES

THE CHINESE AND INDO-CHINESE SPECIES OF ORMOSIA

BY

E. D. MERRILL AND LUETTA CHEN

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A REVISION OF THE GENUS SABIA COLEBROOKE

LUETTA CHEN

with nine text-figures

I. INTRODUCTION

One reason for selecting this group for monographic study was the difficulty encountered by all botanists in making species determinations of current collections, for many species were originally rather inadequately described, and the relationships of others were poorly understood. Another cogent reason was that no previous attempt has been made by any botanist to monograph the entire genus, all previous studies having involved merely the general generic considerations in standard works, treatments of species occurring in limited areas, and incidental descriptions of new species in connection with general floristic studies. The project thus involved a consideration of all characters that might prove to be of value in the establishment of minor groups, as well as those that might prove to be significant in the delimitation of species. The work has been handicapped by my inability to study certain types and historical specimens preserved in various European herbaria, as it was clearly inexpedient even to attempt to borrow types because of the unsettled conditions incident to the present war. Thus I have been limited in my studies to material preserved in the larger American herbaria, supplemented by such specimens as it has been possible to borrow from oriental institutions. Naturally all available literature has been intensively studied.

In the case of three species, *Sabia malabarica* Bedd., *S. tomentosa* Hook. f., and *S. Wardii* W. W. Smith, I have been obliged to rely largely on the published descriptions, although, through the courtesy of Sir W. W. Smith of Edinburgh and Dr. A. D. Cotton of Kew, who supplied me with flowers from type or authentic specimens, I was able to determine the disc characters of these species. I have seen but a single flower of *Sabia malabarica* Bedd. and no material representing the type collection of *Sabia pauciflora* Blume, although from Miquel's amplified description of the latter and his excellent illustration I feel satisfied in my interpretation of the species.

In adopting a basic classification utilizing certain disc characters, naturally one encounters difficulties when such characters are not critically considered in previously published descriptions. As a rule, the species of *Sabia* are notoriously difficult to interpret from published descriptions alone, as not infrequently one notes, in the course of a monographic study, that what one considers to be essential characters are not mentioned, or if mentioned, then sufficient details are not given by previous authors. I have recognized a total of fifty-three species,[1] a number in rather striking contrast to Bentham & Hooker's estimate of about ten species, Gen. Pl. 1: 414. 1862, and Warburg's estimate of about seventeen "zum

[1] Among the incomplete specimens that have been available to me for study there are several that I am convinced represent undescribed species, but because important parts are lacking I have deferred any consideration of these.

Teil schlecht unterschiedene Arten" in Engler & Prantl, Nat. Pflanzenfam. 3(5): 370–371. 1895.

Sometime previous to his death in August, 1933, possibly as early as 1920, when he published a plate and description of *Sabia latifolia* Rehd. & Wils., Doctor Otto Stapf studied the Indian and the eastern Asiatic species as represented in the herbarium of the Royal Botanic Gardens, Kew. He prepared two provisional keys, one to ten species found in India and Burma, the other to twenty-four species occurring in China, Japan, and Formosa. In these keys he indicated one new species from Burma and ten from China, but he apparently never prepared the technical descriptions of these eleven species, or if he did so, the descriptions were never published. My first knowledge of Stapf's work, other than noting one of his binomials on a photograph of a Kew sheet in the Britton Herbarium, New York Botanical Garden, where Professor Rehder and Dr. Merrill recognized the handwriting as that of Dr. Stapf, was the surprising fact that some Japanese botanist, working at Kew previous to 1936, had copied Stapf's provisional key to the eastern Asiatic species and published a Japanese translation of this as an anonymous paper.[1] There is no evidence that Stapf ever intended to publish these keys in the form in which he prepared them, as both are clearly indicated as "provisional."

I had an English translation of this key prepared in Cambridge, and later received another translation courteously prepared by Dr. Hiroshi Hara of Tokyo. Dr. A. D. Cotton of Kew kindly transmitted copies of both of Stapf's provisional keys, and Dr. Hara's literal translation of the Japanese text appertaining to the Chinese and Japanese species is practically identical with Stapf's original, a clear indication that this anonymous Japanese paper was based on Stapf's provisional key. The only essential differences between the two keys are in the inclusion of *Sabia transarisanensis* Hayata of Formosa, *Sabia dumicola* W. W. Smith of Yunnan, and the proposal of two groups, *Dolicostylae* and *Leptandreae,* in the Japanese text.

The most unfortunate aspect of this occurrence, involving a type of "publication" of binomials most unusual in botanical literature, is that the anonymous Japanese author not only proposed ten new binomials, all as *nomina nuda,* but that he erroneously credited these to S. T. Dunn, rather than to the actual author of the provisional key, Dr. Otto Stapf. Dr. Cotton states that there are in the Kew herbarium two provisional keys prepared by Dr. Stapf, these having been placed in the herbarium by Mr. Sealy in 1933, after Dr. Stapf's death, and marked as the latter's work.

In the one appertaining to the eastern Asiatic species, the names appearing in the Japanese key are recorded. In only a few cases did Dr. Stapf write the names on the herbarium sheets, but he did write them on the species covers and arranged the latter in the sequence of his keys. Mr. Dunn's name and handwriting does not appear on any of the sheets or elsewhere. Thus some Japanese botanist [2] working at Kew, either before or after Dr. Stapf's death, in copying the provisional keys, mistook Dr. Stapf's work for that of Mr. Dunn, and in translating the key into Japanese attributed the binomials to Dunn by error.

[1] **Anonymous.** [Key to the Far Eastern species of Sabia.] Acta Phytotax. Geobot. **5**: 76–78. 1936.

[2] While this can be treated only as an anonymous publication, in view of the absence of definite information as to who actually prepared the translation, the evidence at hand indicates that the author was Dr. G. Koidzumi, editor of the Acta Phytotaxonomica Geobotanica.

These binomials, being printed in a key composed otherwise wholly of Japanese characters and unaccompanied by descriptions, are *nomina nuda;* they are *Sabia acutisepala, S. fasciculata, S. gaultherifolia, S. olacifolia, S. omeiensis, S. pallida, S. rotundata, S. sinensis, S. spinosa,* and *S. subcorymbosa.*

Fortunately, I am able to account for most of these species, as duplicate specimens of many of the individual collections actually named by Stapf at Kew are available in American herbaria, while in the case of a few species single flowers and for several of the sheets actual photographs were received from Kew through the kindness of Dr. A. D. Cotton. The available material representing *Sabia acutisepala* and *S. rotundata* is so incomplete that I have not been able to determine the status and relationships of these and have merely included the names in the list of doubtful and excluded species at the end of this paper.

After an intensive study of all data and material available to me, and despite a few reductions of previously proposed species, I recognize fifty-three species, twenty-four of which (including certain species named in the Kew herbarium by Stapf and by Lecomte, but not hitherto described) are herein described as new; most of these previously undescribed species are from China. Even before the reference collections of the Arnold Arboretum were vastly increased by very large and important accessions in the past few years, through field work prosecuted in China by representatives of various Chinese institutions and in part supported by modest grants from the Arnold Arboretum, it was manifest that the genus *Sabia* reached its highest development in number of species in China. Previous to 1930 and possibly as early as 1920, Dr. Stapf had indicated in his then unpublished key that twenty-four Chinese species were known to him and represented in the Kew Herbarium. More than half of the now known species are confined to that country, with eleven known from India (including Burma), while in other regions to which the genus extends, such as Japan, Formosa, Indo-China, Thailand (Siam), the Malay Peninsula, Sumatra, Java, Borneo, the Philippines, the Moluccas, New Guinea, and the Solomon Islands, the species are few in number, often only one or two in each region mentioned. It may be confidently expected that additional species will be found in China as exploration progresses, but it may be doubted if many additional new forms will be found in the periphery of the generic range, especially in the east and south, such as Japan and Formosa, the Philippines, Malaysia, and Papuasia.

II. GENERAL HISTORICAL REVIEW

The genus *Sabia* was proposed, described, and illustrated by Colebrooke, Trans. Linn. Soc. 12: 355. *t. 14.* 1819, the single species known to him being *Sabia lanceolata* Colebr., a native of Silhet; the source of the generic name was the Bengalese vernacular name *Sabjá-lat.* He placed the genus under the Linnaean system in the Pentandria-Monogynia. Between 1818 and 1941 about forty-five species were described, some of which have previously been reduced to synonymy, while others have been shown to appertain to genera other than *Sabia,* some even to genera in other families than the Sabiaceae. No intensive study of all representatives of the genus has previously been attempted.

In the first edition of Roxburgh's Flora Indica (that of Carey and Wallich) 2: 308–312. 1824, Wallich included Colebrooke's species and described two new ones from Nepal; these descriptions do not appear in the second edition of Roxburgh's work, 1832, which was limited to that author's own text. In 1855 Hooker f. and Thomson, Fl. Ind. 209–211. 1855, increased the number of Indian

species to seven. An additional one was described from southern India by Beddome, Ic. Pl. Ind. Or. **1**: 39. *t.* 177. 1874, and finally Hooker f., Fl. Brit. Ind. 2: 1–3. 1876, considered ten species, including one from the Andaman Islands, which, however, was later shown to belong in the euphorbiaceous genus *Blachia*. In various local floras appertaining to parts of India issued up to 1937, no additional species are included, but in 1917 W. W. Smith, Notes Bot. Gard. Edinb. **10**: 63. 1917, described a single new species from Upper Burma.

One species was described from Java by Blume, Bijdr. 29. 1825 (as *Meniscosta javanica* Blume), but on re-studying it twenty-five years later, Mus. Bot. Lugd.-Bat. **1**: 369. 1851, he correctly reduced his genus *Meniscosta* to *Sabia* and at the same time briefly described an additional new species from Sumatra and another from the Moluccas. Miquel, Fl. Ind. Bat. **1**(2): 618–619. 1859, accepted Blume's three species of *Sabia* with very abbreviated descriptions, and three years later, Fl. Ind. Bat. Suppl. 520–521. 1862, described three new ones from Sumatra. Still later he provided detailed descriptions and excellent illustrations of several of the Malaysian species, Illus. Fl. Archip. Ind. 71–73. *t.* 31–33. 1871; at the same time he reduced two of his own Sumatran species, *Sabia floribunda* Miq. and *Sabia densiflora* Miq., to *Meliosma simplicifolia* (Roxb.) Walp. Stapf, Trans. Linn. Soc. II. Bot. **4**: 142. 1894, extended the range of *Sabia parviflora* Wall. to Borneo, while in 1901 Warburg, in K. Schumann and Lauterbach, Fl. Deutsch. Schutzgeb. Südsee 425, described a single species from New Guinea. King, Jour. As. Soc. Bengal **65**(2): 454–455. 1896 (Mater. Fl. Malay. Penin. 2: 740–741), extended the ranges of *Sabia sumatrana* Blume and *Sabia limoniacea* Wall. to the Malay Peninsula and disposed of *Sabia viridissima* Kurz by transferring it *Blachia* of the Euphorbiaceae, as *B. viridissima* (Kurz) King, at the same time calling attention to the fact that Kurz's herbarium material, in part, represented *Erythropalum scandens* Roxb. Ridley, Fl. Malay Pen. **1**: 513. 1922, recognized the same two species for the Malay Peninsula as did King. For the Philippine Islands, C. B. Robinson described one species from Luzon, Bull. Torr. Bot. Club **35**: 70, 74. 1908, and a year later Elmer, Leafl. Philip. Bot. 2: 579. 1909, described a second one from Negros. Lecomte, Fl. Gén. Indo-Chine 2: 2. 1908, extended the range of *Sabia parviflora* Wall. to Indo-China, reducing *Sabia Harmandiana* Pierre to synonymy, yet at the same time giving the latter varietal status (*in nota*), while Craib, Fl. Siam. Enum. **1**: 340. 1926, recorded *Sabia Harmandiana* Pierre from Thailand (Siam), considering that in its pubescent inflorescences it was specifically distinct from *S. parviflora* Wall., which has glabrous inflorescences.

Four species were recorded from China in the preceding century, and in the present century, through the work of Diels, Hemsley, Lecomte, Dunn, Léveillé, Rehder and Wilson, and W. W. Smith, this number was considerably increased, attaining a total of approximately twenty, until Rehder, Jour. Arnold Arb. **14**: 224. 1933, **15**: 309. 1934, by an intensive study of Léveillé's types, indicated that four so-called species of *Sabia* really belong in *Orixa, Iodes,* and *Gardneria,* of the Celastraceae, Icacinaceae, and Loganiaceae respectively, while two others were reduced to synonymy under *Sabia*. Two species occur in Formosa and one in Japan proper.

From this brief review it will be noted that the published descriptive data are widely scattered. No botanist who has described incidental species has apparently even attempted a general survey of the entire genus (other than the possibility that Stapf did this in part), and as a result there is a great lack of

coordination in the treatments by various authors. Thus, when it was observed that there are apparently excellent differentiative characters in the floral disc, in a genus where striking differential specific characters are often obscure, it developed that, particularly in many of the older published descriptions, no mention or very casual mention had been made of the disc characters. In a study of this type, where certain floral characters have been shown to be significant, it is most essential, in the interpretation of the older described species, that these characters be re-examined; this can be done only when the investigator has access to type material or authentically named specimens.

III. GENERIC SYNONYMY

The generic synonymy is relatively simple. Colebrooke's description and illustration of the type species, *Sabia lanceolata* Colebr. Trans. Linn. Soc. **12**: 355. *t. 14*. 1819, clearly indicate the essential characters of the group. Blume, Bijdr. 29. 1825, proposed the genus *Meniscosta*, with a single species, which, twenty-six years later, Mus. Bot. Lugd.-Bat. **1**: 369. 1851, he correctly reduced to *Sabia* Colebr. In the meantime, Dietrich, apparently through a *lapsus calami*, Syn. Pl. **2**: 923. 1840, had used the variant spelling *Menicosta*. *Enantia* Falconer, Hook. Jour. Bot. **4**: 75. 1842, was incidentally published without a binomial, based on material from India. This is unquestionably a synonym of *Sabia* Colebr., where it was placed by Bentham and Hooker f. Gen. Pl. **1**: 414. 1862. *Androglossum* Champ. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 42. 1852, based on a specimen from Hongkong, was correctly reduced by Seemann, Bot. Voy. Herald 362. 1857, to *Sabia* Colebr., but Champion's type species is not the same as *Sabia paniculata* Edgw., where Seemann placed it. A slight variant in the generic name is *Androglossa*, as used by Dalla Torre and Harms, Gen. Siphon. 300. 1901.

IV. MORPHOLOGY

The representatives of the genus *Sabia* are scandent or suberect, rarely erect, and, except for a single species, unarmed shrubs. Most of the species are evergreen, some being deciduous, and in these latter the flowers appear before or with the young leaves. The terete branches and branchlets are entirely glabrous or sometimes more or less pubescent; lenticels may or may not be present. Lecomte[1] states: "Toutes les espèces du genre *Sabia* possèdent de jeunes rameaux très finement striés en long sur le sec, et cette particularité est due à la présence de rayons médullaires dont les cellules ont une membrane épaissie et lignifiée. Ces rayons se continuent habituellement en dehors du bois dans le liber, de telle façon que, par la dessiccation et la contraction des éléments mous de l'écorce sur ces côtes longitudinales, une fine striation se dessine très nettement." This is in general an excellent statement of the case.

I also quote Lecomte's statement (op. cit. 673) regarding the axillary buds which are characteristic of most species: "En outre, dans toutes les espèces, chaque feuille porte, à son aisselle, deux bourgeons superposés et d'inégale valeur; le plus voisin de la feuille, qui se développera le premier et donnera toujours un pédicelle floral, ne possède pas d'appareil protecteur; le plus élevé, se développant plus tard et devant par conséquent présenter une période de vie latente, est protégé par des écailles dont le nombre, la forme et l'épaisseur varient avec les espèces et constituent une périule (de Mirbel). Chacun des ces bour-

[1] Bull. Soc. Bot. France **54**: 672–673. 1907.

geons ne donnera qu'un rameau feuillé et, à l'aisselle de chacune des feuilles de ce rameau, on retrouvera la même dualité de bourgeons signalée plus haut. Quand le bourgeon floral ne se développe pas, comme dans le *S. limoniacea* Wall., c'est le bourgeon périlé qui fournit l'inflorescence, mais une inflorescence à petites feuilles, dans laquelle les pédicelles floraux entraînent, par leur développement, la réduction de l'appareil végétatif. Il en est de même et, d'une façon plus accentuée, dans le *Sabia Menicosta* Bl." The bud-scales are in general ovate, broadly ovate, or lanceolate, pubescent or glabrous, the margins eciliate or shortly ciliate.

Sabia japonica Maxim. is the only known species where some of the leaf buds and the young branchlets are subtended by short, often somewhat thickened, spine-like structures, these being apparently formed by the persistent basal portions of the petioles, which to a certain degree elongate below the abcission layer and become thickened and indurated.

Leaf: The leaves are simple, alternate, penninerved, petiolate, exstipulate, and may be pubescent or glabrous, in few species being minutely and very obscurely reddish-glandular on the lower surface. They vary from membranaceous to coriaceous in texture; they are always entire, with the margins in most species narrowly cartilagineous or scarious-cartilagineous, often very narrowly revolute, sometimes ciliate or minutely erose, but never toothed. The lateral nerves are mostly slender, usually more or less distinct, often raised beneath, spreading or curved, and arcuate-anastomosing, the secondary and tertiary veins varying considerably and forming a lax or compact, distinct to more or less obscure reticulation.

Inflorescences: The inflorescences are always axillary and mostly solitary. The simplest form, and this largely confined to the deciduous species wherein the flowers and leaves are coetaneous or the flowers appear just after the leaves are formed, consists of solitary pedicelled flowers, or sometimes from one to three flowers in an axillary fascicle. In a few species the flowers are arranged in simple racemes. In most of the species the flowers are cymose or in the simpler forms umbellate or umbellate-cymose, the individual cymes being solitary, often slenderly peduncled and simple or compound; in other species the cymules, few to many in number, are racemosely arranged in short to greatly elongated, usually narrowly paniculate or racemiform-paniculate inflorescences, occasionally these compound inflorescences bearing a few small leaves subtending the secondary axes. The small flowers, always pedicellate, are subtended by small, linear or lanceolate, persistent or deciduous, pubescent or glabrous bracteoles.

Flowers: The flowers are always perfect, regular, normally 5-merous, rarely 4- or 6-merous, small, and vary in color from green, greenish-white, or white to yellow, pink, red, or purple. The opposition between the floral parts is striking, the petals being opposite the sepals, the stamens opposite the petals.

Calyx: In general, the persistent calyx is small, pubescent or glabrous, with or without 1 or 2 minute bracteoles at the base, and normally 5-partite. Warburg, Bentham & Hooker, Hooker f., Ridley, and others state that the calyx is rarely 4-partite, but I have observed only 5-partite calyces. The sepals are thin to fairly thick, pubescent or glabrous, in some species minutely and obscurely punctate-glandular with colored dots, mostly ovate, broadly ovate, subrotund or oblong, mostly equal but in some species distinctly unequal in size,

3–5-nerved, the nerves prominent or obscure, the tips acute, obtuse, or broadly rounded, rarely emarginate, the margins ciliate or eciliate.

Corolla: The petals are normally five in number, exceptionally four or six petals being noted, but on the same plant with these one notes typically 5-merous flowers. They are always free, imbricate, opposite the sepals, varying in shape but mostly oblong, lanceolate, broadly ovate, or broadly obovate, sometimes suborbicular-obovate or elliptic. In a few species they are strongly narrowed upward; the apices vary from broadly rounded or obtuse to subacute or even slightly acuminate. In most species the petals are deciduous, but in some they persist at the bases of the maturing carpidia. They are mostly rather thin, 3–9-nerved, the nerves rather prominent or obscure, and with or without numerous, small, often obscure, reddish-glandular dots. Their margins may be glabrous or shortly ciliate, but other than for these short marginal hairs they are always glabrous.

Stamens: The stamens are free, opposite the petals and normally 5, rarely 6 and even more rarely 4, equal or subequal, all antheriferous and fertile. The filaments are long or short, glabrous, slender or somewhat thickened, often complanate and more or less widened below, sometimes obscurely and minutely reddish glandular-punctate. The anthers are always small, didymous, ovoid or oblong, the cells separated by a thickened connective; they may be introrse or extrorse. The pollen-grains are globose to ellipsoid, when globose varying from 24 to 31 microns in diameter, when ellipsoid 27–33 by 22–29 microns in size. The surface varies from almost smooth to finely, medium, or even massively pitted, the pores being rounded-oblong. These observations were made on the pollen of six species, *Sabia philippinensis* C. B. Robinson, *S. parviflora* Wall., *S. javanica* (Bl.) Backer, *S. campanulata* Wall., *S. kachinica* Chen, and *S. lanceolata* Colebr., none being closely allied to each other, with the exception of the first two.

Disc and glands: From numerous dissections and comparisons, I conclude that the disc provides dependable sectional characters. The disc characters, as a matter of fact, impress me as being more dependable and significant than the long or short styles, or whether the species be deciduous or evergreen, or the flowers solitary or in more or less compound inflorescences. The disc varies in shape and its margins are characteristic; some are cup-shaped, with or without projecting ribs, shallowly to deeply lobed, the lobes being small, acute, obtuse or rounded; some are tumid, with or without projecting ribs, the margins smooth, annular or at most obscurely crenate or wavy, never distinctly toothed. Another important character peculiar to certain species is the presence of small or minute glands arising from a more or less pronounced thickening in the disc-body. These glands are either disciform or irregularly disciform, never numerous, generally 2–5, inserted on the sides or on the tips of the disc-lobes or in some species on the sides of the disc or on the median parts of the projecting ribs. These glands have been overlooked by most botanists, but Baillon, Hist. Pl. 5: 345. 1874, states: "Les filets sont insérés à la base d'un pied cylindrique qui supporte le gynécée et qui s'épaissit dans l'intervalle des étamines en cinq côtes saillantes dont l'extrémité supérieure proémine quelquefois en haut à la façon d'une glande alternipétale." Warburg, in Engler & Prantl, Nat. Pflanzenfam. 3(5): 371. 1896, states: "Frkn. von einem kurzen, kronenartig 5-spitzigen Discus umgeben, die drüsigen Spitzen mit den Stb. alternierend." These are the only two authors who, to my knowledge, have discussed the glands.

OVARY: The superior ovary is commonly more or less immersed within the disc. It is ovoid or subconical, rarely pyramidal, pubescent or glabrous, consisting, as far as I have observed, of two carpels, although Baillon, Warburg, Bentham & Hooker f., King, Ridley, and others report 2- or 3-carpellary ovaries, and Bentham, Fl. Hongk. 70. 1861, speaks of the ovary as "1- or 2-celled." The carpels are laterally compressed and opposite, more or less coherent at the ventral side. The ovules are 2 in each carpel, usually superimposed on the placenta.

STYLES and STIGMAS: The styles are normally united for their whole length at anthesis, varying in length from 0.2 mm. to 5 mm., but as the fruits develop the styles usually separate from the base upward and are ultimately quite free. At anthesis they are strictly terminal, but in the developing carpel they are persistent and remain lateral and almost basal on the adaxial side of the usually somewhat inequilateral carpidium. They are mostly glabrous, in a few species sparingly pubescent, narrowed upward, occasionally minutely and obscurely reddish punctate-glandular. The stigmas are minute, terminal, and rounded or capitate.

FRUIT: The fruit consists of two carpels, one of which frequently aborts. The individual carpidium is drupaceous, more or less compressed, indehiscent and one-seeded, reniform, subreniform, suborbicular, sometimes obovate or pyriform, never more than 1.5 cm. in diameter, glabrous or nearly so. The wall consists of two distinct layers: an outer fleshy and smooth exocarp which, when fresh, varies from white to pinkish-red, red, dark blue, or almost black, and the crustaceous and more or less prominently scrobiculate or pitted endocarp, this character becoming evident in the dried fruit. The seeds are compressed and are characteristically covered by numerous minute dark-reddish glands, which only Warburg, in Engler & Prantl, Nat. Pflanzenfam. 3(5): 371. 1896, appears to have noticed. The testa or seed-coat is thick. The endosperm, if present at all, is reduced to a very thin layer adhering to the inner seed-coat. The cotyledons are flat, fairly thick, slightly rugose or undulate, straight or incurved; the radicle is inferior, curved, and cylindric.

V. SYSTEMATIC CONSIDERATIONS

The family Sabiaceae was proposed by Blume, Mus. Bot. Lugd.-Bat. 1: 368. 1851, to take the genus *Sabia* Colebrooke (*Meniscosta* Blume), but Planchon, Bentham & Hooker f., Baillon, Warburg, and others have expanded the family so that now four genera are currently recognized: *Sabia, Meliosma, Phoxanthus,* and *Ophiocaryon. Phoxanthus* Benth. and *Ophiocaryon* Schomb. are monotypic genera of Brazil and Guiana; *Meliosma* Blume, with between one hundred thirty and one hundred forty described species, is the largest genus, with approximately thirty-five species occurring in Mexico, Central America, the West Indies, and South America, the remaining three-fourths of the proposed species being characteristic of the Indo-Malaysian and Indo-Chinese regions, the Old World generic range being from northern India to Ceylon eastward to Korea and Japan and southward through Malaysia to New Guinea. The remaining genus, *Sabia* Colebrooke, wholly confined to the Indo-Malaysian and Indo-Chinese regions, is the subject of the present detailed study.

In reference to the accepted family name it may be noted that when Endlicher, Gen. Pl. 1074. 1840, proposed the designation Meliosmea as a subgroup of the Sapindaceae to take only the genus *Meliosma* Blume, he did not treat this as

having independent family status. In a brief paper published by Planchon on the affinities of the genus *Ophiocaryon,* Fl. Serr. Jard. Europe 5: 532c–532d, 533c. 1849, he listed *Llavea* Planch. (= *Meliosma* Blume), *Ophiocaryon* Schomb., and *Sabia* Colebr. (*Meniscosta* Blume) as constituting "un groupe naturel auquel nous conservons le nom de Méliosmées, créé par Endlicher pour le seul genre *Meliosma,* et subordonné par lui au titre plus général de Sapindacées," and stated that its affinities were not with the Sapindaceae. Later, Ann. Sci. Nat. IV. Bot. 3: 296. 1855, in again discussing the position of *Ophiocaryon,* he states: "On place d'ordinaire les Méliosmées parmi les Sapindacées, ou du moins tout à côté d'elles." After discussing its relationships with various families now placed in the Sapindales and certain genera of the Anacardiaceae, he concludes: "Par ces raisons et par l'analogie de facies, je placerais volontiers les Méliosmées à la suite des Térébinthacées" (Anacardiaceae).

As Planchon's rather casual original treatment antedates Blume's proposal of the Sabiaceae by about two years, there might be a valid argument for replacing the family name Sabiaceae by Planchon's designation, although such action would be objectionable in view of the general acceptance of Blume's family name.

Bentham & Hooker f., Gen. Pl. 1: 413–415. 1862, accepted the family Sabiaceae, by them interpreted to include four genera, *Sabia, Meliosma, Phoxanthus,* and *Ophiocaryon,* and placed it between the Sapindaceae and the Anacardiaceae. Warburg, in Engler & Prantl, Nat. Pflanzenfam. 3(5): 367–374. 1895, recognizing the same genera as did Bentham & Hooker f., left the family in the Sapindales between the Sapindaceae and the Melianthaceae. Wettstein, Handb. Syst. Bot. ed. 3. 734. 1924, placed the family in the Terebinthales with and following the Sapindaceae and the Hippocastaneaceae, and Hutchinson, Fam. Fl. Pl. Dicot. 254. 1926, suggested no change in position, leaving it in the Sapindales following the Sapindaceae and the Aceraceae.

The genus *Sabia* is most highly developed in the number of species in China, and especially in southwestern China, fairly well represented in northern India, but with only one species in southern India, and poorly represented in other parts of its generic range, such as Japan and Formosa, the Philippines, Siam, Indo-China, the Malay Peninsula, Sumatra, Java, Borneo, the Moluccas, New Guinea, and the Solomon Islands. It is rather strikingly differentiated by the opposition of its floral parts, normally 5 petals opposite the 5 sepals, 5 fertile stamens opposite the 5 petals, by its very characteristic carpidia, and by the in general scandent habit of the rather numerous species. Again, in many of the species various floral parts are provided with minute, obscure, more or less colored glandular dots, while many species are characterized by having few indurated disciform glands on the margins or sides of the disc or on the tips of the disc-lobes. Attention is called to the fact that the obscure glandular-punctate characters of the floral parts of certain species can be detected with certainty only under a reasonably high-powered binocular, rarely with an ordinary hand lens.

Wallich, in Roxb. Fl. Ind. 2: 308. 1824, suggested that *Sabia* resembled the Terebinthaceae (= Anacardiaceae) because of its general characters and the presence of small colored punctate glands. A year later de Candolle, Prodr. 2: 89. 1825, merely listed the genus in his treatment of this family as among the allied and insufficiently known genera. Meissner, Pl. Vasc. Gen. 1: 76, 2: 55, 1836–1843, retained the genus as an anomalous one in the Anacardiaceae.

When Blume proposed the genus *Meniscosta*, Bijdr. 29. 1825, which he later reduced to *Sabia*, he thought it to be related to the Menispermaceae, from which, however, it differs very radically; Blume was apparently misled by the superficial characters of the carpidia, which in general appearance are suggestive of the fruits of certain menispermaceous genera; the fruits structurally, however, as well as the floral details, clearly show that *Sabia* is remote from the Menispermaceae. Miers, in Lindley, Veg. Kingd. ed. 3. 467a–477b. 1853, thought that the Sabiaceae was intermediate between the Menispermaceae and the Lardizabalaceae. Hooker f. & Thomson, Fl. Ind. **1**: 208. 1855, suggested that it was intermediate between the Schizandraceae and the Menispermaceae. Planchon, however, Fl. Serr. Jard. Europe **5**: 533c. 1849, Ann. Sci. Nat. IV. Bot. **3**: 296. 1855, proposed that it should be placed in the family "Meliosmées" following the Anacardiaceae, and he seems to be the first botanist to suggest what all future investigators have accepted as the proper place of the genus, i.e., in the alliance with *Meliosma* Blume. When Blume in 1851 proposed the family Sabiaceae to take the genus *Sabia* he stated, Mus. Bot. Lugd.-Bat. **1**: 368. 1851: "Genus typum parvi Ordinis inter Menispermaceas et Lardizabalaceas medii exhibens. Auctores alii Terebinthaceis, Sapindaceis alii illud annumeravere, etsi tam habitus, quam maxime fructus fabrica affinitatem cum Menispermaceis indicat." It is perhaps worthy of note that Planchon, Ann. Sci. Nat. IV. Bot. **3**: 296. 1855, noted certain characters that suggest the Myrsinaceae, and in one case at least, a species of *Sabia* was described as a representative of the genus *Myrsine* (see *Sabia limoniacea* Wall. var. *ardisioides* Chen infra, p. 58). Planchon states: "Notons en passant les singulières coïncidences qui se présentent sur divers points de la structure, et même de l'aspect entre les Méliosmées et Myrsinées, particulièrement entre les *Sabia* et les *Embelia*. Même opposition des étamines aux pétales; mêmes ponctuations glanduleuses dans le tissu des fleurs; enfin cette ressemblance de facies que l'oeil saisit sans que la plume puisse le rendre. Ce sont là des traits utiles à signaler, alors même que les diversités si flagrantes dans la structure des fruits s'opposent à tout rapprochement immediat entre les familles en question."

Bentham & Hooker f., Gen. Pl. 1: 414. 1862, in accepting the Sabiaceae, state regarding *Sabia*, "Sabia genus est singulare, ob bracteas sepala petala stamina et ovarii lobos omnia opposita; a variis auctoribus prope *Menispermaceas* positum est, sed toto coelo differt floribus 5-meris hermaphroditis, ovario vere syncarpo, et ceterum manifeste *Meliosmati* et *Phoxantho* arcte affine est."

Baillon, Hist. Pl. **5**: 393. 1874, limited his subsidiary group II Sabieae to *Sabia* and *Meliosma*, retaining the Sabieae in the Sapindaceae. In the widely used Endlicher system as modified by Engler and Prantl, Warburg, in Engl. & Prantl, Nat. Pflanzenfam. 3(5): 366–374. 1895, accepted the treatment of Bentham & Hooker f., placing the genus *Sabia* in the Sabiaceae-Sabieae, and *Meliosma, Phoxanthus,* and *Ophiocaryon* in the Sabiaceae-Meliosmeae. He placed the family in the Sapindales between the Sapindaceae and the Melianthaceae. In a still more recent treatment, Wettstein, Handb. Syst. Bot. ed. 3. 734. 1924, placed it in the order Terebinthales following the Sapindaceae, Aceraceae, and Hippocastaneaceae, while Hutchinson, Fam. Fl. Pl. Dicot. 254. 1926, leaves it in the Sapindales following the Sapindaceae and the Aceraceae. It is thus clear that modern authors are in approximate agreement as to the place that the Sabiaceae occupies in various arrangements of the families of the flowering plants. The family is, of course, typified by the genus *Sabia* Colebrooke.

VI. DISTRIBUTION

Sabia Colebr. is characteristic of certain tropical and subtropical regions of the Old World, having no representatives in Africa and Madagascar, Australia, Polynesia, and the New World. The greatest development in species occurs in China, from which country thirty-six species and nine varieties are recognized in this revision; within China the largest number of forms is found in the extreme southwest in Yunnan Province, where twenty-one species are now known. In the remaining provinces the number of species in each is much smaller, sometimes only one or two, but the genus is represented in all of the southern and central provinces, the most northern ones in which representatives of the genus occur being Kansu (a single species as yet unnamed), Shensi, and Kiangsu.

In India, excluding Burma, nine species are known, while ten are known from Burma, for Lace & Rodger, List of Trees, Shrubs, Climbers of Burma 43. 1922, record six species from that country, while four are below described as new. Thailand (Siam) has two species, Indo-China two, and the Malay Peninsula two. One species occurs in Japan proper, this being the most northern in the range of the genus, and two in Formosa. In the Malay Archipelago, including the Philippines, the genus is not strongly represented. There are three species and one variety known from Sumatra, one species and one variety from Java, three species and one variety from Borneo, two from the Philippines, and one from the Moluccas, New Guinea, and the Solomon Islands. Most of the species are of rather local occurrence, no single one even approximating the entire range of the genus, which is from the temperate and tropical Himalayan region (one species in Peninsular India) through China to southern Japan and Formosa southward through the Philippines and Malaysia to New Guinea and the Solomon Islands. The two most widely distributed species are *Sabia limoniacea* Wall. and *Sabia parviflora* Wall., the former extending from northern India to Burma, Siam, Malay Peninsula, Sumatra, Yunnan, and including its var. *ardisioides* Chen, to Kwangsi, Kwangtung, Hainan, and Hongkong in China, the latter extending from northern India to Burma, Yunnan, Kweichow, Kwangsi, Indo-China, and Borneo and, including its var. *Harmandiana* (Pierre) Lecomte, to Yunnan, Indo-China, Siam, and Borneo.

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VIII. EXPLANATION OF CITATIONS

The types of the new species herein described, unless otherwise stated, are deposited in the Herbarium of the Arnold Arboretum. The abbreviations adopted in this revision to indicate the herbaria in which the cited specimens are deposited are as follows:

A. Herbarium of the Arnold Arboretum, Harvard University.
B. Herbarium of the Botanical Garden, Buitenzorg, Java.
C. Herbarium of the University of California, Berkeley, California.
E. Herbarium of the Royal Botanic Garden, Edinburgh.
G. Gray Herbarium, Harvard University.
K. Herbarium of the Royal Botanic Gardens, Kew.
L. Herbarium of Lingnan University, Canton, China.
N. Britton Herbarium, New York Botanical Garden, New York.
P. Herbarium of the Bureau of Science, Manila, P. I.
U. United States National Herbarium, Washington, D. C.

IX. TAXONOMY

Sabia Colebrooke, Trans. Linn. Soc. **12**: 355. *t. 14.* 1819; Wall. in Roxb. Fl. Ind. **2**: 308. 1824; Endl. Gen. Pl. 1135. 1840; Blume, Mus. Bot. Lugd.-Bat. **1**: 368. 1851; Benth. Fl. Hongk. 70. 1861; Benth. & Hook. f. Gen. Pl. **1**: 414. 1862; Baill. Hist. Pl. **5**: 345. *f. 342.* 1874; Hook. f. Fl. Brit. Ind. **2**: 1. 1879; Kurz, For. Fl. Brit. Burma. **1**: 300. 1877; Warb. in Engl. & Prantl, Nat. Pflanzenfam. **3**(5): 370. *f. 184. A–H.* 1896; King, Jour. As. Soc. Bengal **65**(*2*): 454. 1896 (Mater. Fl. Malay. Pen. **2**: 740); Ridley, Fl. Malay Pen. **1**: 513. 1922; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 324. 1937.

Meniscosta Blume, Bijdr. 28. 1825.

Menicosta Dietrich, Synop. Pl. **2**: 923. 1840.

Enantia Falconer, Hook. Jour. Bot. **4**: 75. 1842.

Androglossum Champion ex Benth. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 42. 1852.

Androglossa Dalla Torre et Harms, Gen. Siph. 300. 1901.

Deciduous or evergreen, mostly scandent shrubs or large climbers, sometimes suberect, rarely erect, glabrous or more or less pubescent, but never densely so; branches terete or flexuous, striate, pubescent or glabrous; branchlets with bud-scales at their bases, terete, striate, pubescent or glabrous, unarmed (except *Sabia japonica* Maxim., in which short indurated spine-like structures subtending the young branchlets occur, sometimes also below leafless nodes); bud-scales pubescent or glabrous, ovate, broadly ovate or lanceolate, their margins ciliate or eciliate; leaves simple, alternate, penninerved, petiolate, exstipulate, glabrous or

sparingly pubescent, sometimes with obscure minute colored glandular dots on the lower surface, various in texture, ranging from membranaceous to rather thickly coriaceous, always entire, the margins mostly narrowly cartilagineous and revolute, ciliate or eciliate, sometimes minutely erose, but never toothed, the lateral nerves generally arcuate-anastomosing, the secondary and tertiary veins varying considerably and forming a lax or compact reticulation. Flowers, when solitary, and inflorescences always axillary, the commonest type of inflorescence being a simple or compound few- to many-flowered cyme borne on often slender peduncles of varying lengths, in the axil of the subtending leaf; the flowers are rarely in simple racemes, while in some species the inflorescences are paniculate, the panicles rather short to as long as the leaves, composed of few to many racemosely arranged simple or more or less compound cymes or cymules, occasionally the primary branch (axis of panicle) more or less leafy, and very nearly intermediate in appearance between a true vegetative shoot and the rachis of an inflorescence; flowers for the most part relatively few, occasionally numerous, small, mostly 5-merous, varying in color from green or greenish white to white, yellowish, or varying shades of purple, some of the floral parts (especially the petals) varying from 4 to 6; peduncles and pedicels generally slender, usually elongating and often more or less clavate in fruit, pubescent or glabrous; bracteoles pubescent or glabrous, linear or lanceolate, persistent or caducous, their margins always ciliate; flowers 4–10 mm. in diameter, rarely larger; calyx persistent, small or minute, pubescent or glabrous, sometimes with one or two bracteoles at the base; sepals 5, opposite the petals, equal or rarely distinctly unequal, with or without minute obscure glandular dots, ovate, broadly ovate or subrounded, rarely oblong, usually 1 mm. long, rarely 2–3 mm. long, 1–2 mm. wide, 3–5-nerved, the nerves prominent or obscure, the apex acute, obtuse or rounded, rarely emarginate, the margins ciliate or eciliate; petals opposite the stamens, imbricate, typically 5, rarely 6 or 4, equal or subequal, thin to fairly thick, with or without obscure minute, colored, glandular dots, variable in shape, but mostly lanceolate, ovate, broadly ovate or obovate, sometimes elliptic or oblong, mostly 2–7 mm. long (very rarely longer), 1–5 mm. wide, 3–9-nerved, the nerves prominent or obscure, the apex acute, obtuse or rounded, sometimes acuminate, the margins ciliate or eciliate; stamens typically 5, rarely 6 or 4, opposite the petals, equal or subequal, free, attached at the base of the petals, all fertile; filaments linear or filiform, complanate, subulate or subclavate, often widened below, equal or subequal, 0.5–5 mm. long, rarely longer, glabrous, with or without obscure minute colored glandular dots; anthers ovoid or oblong, 0.5–1 mm. long, introrsely or extrorsely attached; disc cup-shaped, with or without 5 projecting ribs, the margin irregularly or regularly shallowly to deeply lobed, the lobes minute, acute, obtuse or rounded (§ *Odontodiscus*), or tumid, with or without 2–5 projecting ribs, the margin smooth, annular, or at most obscurely crenate or wavy, and not distinctly toothed (§ *Pachydiscus*); indurated glands (sometimes absent) generally 2–5, minute to small, disciform or irregularly disciform, prominent or obscure, inserted on the disc-lobes, either at the tips or on the sides, sometimes on the sides of the disc or on the projecting ribs; ovary superior, ovoid or subconical, rarely pyramidal, glabrous or pubescent, with or without minute obscure colored glandular dots, the stigmas terminal, minute, rounded or capitate, the styles always more or less persistent and attached basally to the adaxial side of the mature carpel; fruit often with one of the carpels aborted, the carpidium drupaceous, compressed, indehiscent, one-seeded, reniform, subreniform, or suborbicular, rarely obovate or pyriform, never more than 1.5 cm. in diameter (usually smaller), with or without persistent petals at the base; exocarp fleshy and smooth, when fresh white to reddish or dark blue, occasionally black, the endocarp crustaceous and more or less prominently scrobiculate or pitted, this character very evident in the dried fruits; seeds characteristi-

cally covered by numerous minute dark reddish glands; testa thick; endosperm, if present, reduced to a very thin layer adhering to the inner seed-coat or wanting; cotyledons flat, fairly thick, rugose or undulate, straight or incurved; radicle inferior, curved, cylindric.

Species fifty-three, all confined to the Indo-Malaysian and Chinese regions, extending from the northwestern Himalayan region to southern Japan, and southward through Malaysia to New Guinea and the Solomon Islands. In addition to the fifty-three species and eleven varieties recognized in this paper, I have seen incomplete or imperfect material representing about a half-dozen species additional to those herein named and characterized. I have not attempted to name or characterize these, for I am convinced that it would be unwise to do so until more complete material is secured. This applies particularly to certain Chinese deciduous species of which branches and flowers only are at present available.

In his very brief consideration of certain generic characters, Lecomte [1] suggested placing all species with solitary flowers, "pedicelles uniflores," at least those with the pedicels much thickened upward in fruit, in one section (*S. leptandra* Hook. f. & Th., *S. campanulata* Wall., *S. japonica* Maxim., and *S. Schumanniana* Diels). A second suggested section was one to take the species with many-flowered inflorescences, "pedicelles toujours multiflores," the pedicels not much thickened upward in fruit, in which he places his species *S. emarginata* Lec. He proposed no names for these suggested subdivisions of the genus, and only casually mentioned various other described species. He apparently did not make a critical comparative study of all the known species, for he was concerned chiefly with the characterization of his proposed new *Sabia emarginata* Lec. and made no comprehensive review of all the then known species.

Stapf's preliminary study of the genus and his provisional manuscript key, which was unfortunately translated into Japanese and published with no supporting data, is mentioned above. In this key, which I judge Stapf never intended to publish in its original form, he suggested, but did not define, a section *Eusabia* in which he included *S. limoniacea* Wall., *S. parviflora* Wall., *S. subcorymbosa* Stapf, *S. Dielsii* H. Lév., *S. gracilis* Hemsl., and *S. Swinhoei* Hemsl., set off by the first entry in his key: "Flowers widely open, more or less rotate, small; style short, several times shorter than the mature fruit."

The second contrasting primary key division is: "Flowers more or less bell-shaped with the petals broad and conniving; styles long (3 + mm.), growing out during maturation, at length only slightly shorter than the mature fruit." This group, which Stapf did not name, was designated as *Dolicostylae* by the anonymous Japanese author, who translated and published Stapf's provisional key in Japanese,[2] but here again, no technical definition was published. The species included by Stapf were *S. fasciculata* Lec., *S. emarginata* Lec., *S. rotundata* Stapf, *S. discolor* Dunn, *S. coriacea* Rehd. & Wils., *S. yunnanensis* Fr., *S. latifolia* Rehd. & Wils., *S. omeiensis* Stapf, *S. Schumanniana* Diels, *S. acutisepala* Stapf, *S. puberula* Rehd. & Wils., *S. pallida* Stapf, and *S. olacifolia* Stapf.

The third group set off by Stapf, but unnamed, was characterized in his key as: "Flowers solitary, pedicels markedly thickened upwards," and this was named, but not technically characterized, by the Japanese author above referred to, as *Leptandreae*. It included *Sabia gaultherifolia* Stapf, *S. sinensis* Stapf, *S. japonica* Max., *S. Ritchiei* Rehd. & Wils., and *S. spinosa* Stapf.

[1] Bull. Soc. Bot. France **54:** 672–673. 1907.
[2] Acta Phytotax. Geobot. **5:** 76. 1936.

While I have realized that a more or less artificial key could be constructed on the basis of characters suggested by Lecomte and by Stapf, I have considered it expedient to stress the disc characters that I have noted during the course of this study, and have hence divided the species into two groups on the basis of disc characters, for these characters are more or less evident in both flowering and fruiting specimens. As secondary divisions of my key I have utilized various other vegetative, inflorescence, floral, and fruit characters. I realize that my proposed arrangement can be considered only as tentative, for it will be subject to modifications as more abundant material becomes available in the future. I judge, however, that the arrangement I have suggested brings into association manifestly allied species at least as well as any other scheme that has been proposed. The two sections into which I have divided the genus are defined below:

Sectio **Pachydiscus:** Disco valde prominenti, tumido, saepe incrassato vel aucto, plerumque indurato, raro brevi-cylindrico, marginibus integris vel subundulatis obscureque crenatis, nequaquam conspicue dentatis vel lobatis.

Sectio **Odontodiscus:** Disco plus minusve cyathiformi, haud conspicue tumido vel inflato, plerumque vix incrassato, marginibus irregularibus vel regulariter plus minusve profunde dentatis vel lobatis, nequaquam annulatis integrisque vel subintegris.

Key to the species and varieties

A. Disc very prominent, turgid or swollen, rarely short-cylindric, usually thickened, its margins annular or undulate, rarely slightly crenate, never distinctly toothed or lobed. Sect. Pachydiscus.

B. Sepals relatively large, thin, mostly about 2 mm. long and 1 mm. or more wide.

C. Sepals equal, entire; petals elliptic or slightly obovate-elliptic, about 5 × 2.5 mm. (Formosa) ..... 1. *S. transarisanensis.*

C. Sepals very unequal, the larger ones irregularly emarginate; petals orbicular-obovate, about 4 mm. long and wide (Hupeh) ..... 2. *S. emarginata.*

B. Sepals always small, 1 mm. long or less.

C. Flowers coetaneous with the young leaves.

D. Leaves conspicuously pubescent on both surfaces (Yunnan) ..... 3. *S. pubescens.*

D. Leaves glabrous or only sparingly pubescent.

E. Disc longitudinally 3–5-ribbed, each rib with a small indurated gland at about the middle (Yunnan) ..... 4. *S. Rockii.*

E. Disc not ribbed and without indurated glands (Hupeh) ..... 5. *S. Ritchieae.*

C. Flowers appearing after the leaves are fully developed.

D. Ovaries more or less pubescent.

E. Each projecting rib of the disc bearing a small, obscure or prominent, disciform indurated gland at about the middle.

F. Styles more or less pubescent.

G. Peduncles and pedicels pubescent or puberulent (Hupeh, Szechuan). 6. *S. puberula.*

G. Peduncles and pedicels glabrous (Hupeh) .. 6a. *S. puberula* var. *hupehensis.*

F. Styles glabrous (Yunnan, Szechuan) ..... 7. *S. yunnanensis.*

E. Projecting ribs of the disc without indurated glands (Szechuan) .. 8. *S. latifolia.*

D. Ovaries glabrous.

E. Disc with 3–5 more or less distinct longitudinal ribs.

F. Disc without indurated disciform glands.

G. Leaf-bases broadly truncate-rounded or truncate-subcordate; flowers in few-flowered peduncled cymes (Yunnan) ..... 9. *S. Yuii.*

G. Leaf-bases acute to somewhat rounded, never truncate-rounded or truncate-subcordate; flowers in short racemes or solitary.

H. Flowers apparently solitary (unknown); sepals broadly rounded or obtuse; disc much thickened and indurated (Chekiang, Fukien, Kiangsi, Hupeh) ..... 10. *S. gaultheriifolia.*

H. Flowers in short racemes, usually each flower subtended by a small deciduous leaf; sepals acute; disc shortly cylindric, not much thickened or indurated (Yunnan) ..... 11. *S. Metcalfiana.*

F. Disc with several distinct more or less disciform indurated glands either on the sides or on the margins.
G. Indurated glands near the margin of the disc (Yunnan) ... 12. *S. pentadenia.*
G. Indurated glands at about the middle of the disc.
H. Sepals and the basal or median part of the petals minutely reddish-glandular-punctate (Yunnan) ..... 13. *S. Croizatiana.*
H. Sepals and petals epunctate.
I. Cymes much shorter than the leaves.
J. Petioles mostly about 1 cm. long (Szechuan) ..... 14. *S. omeiensis.*
J. Petioles mostly about 5 mm. long (Yunnan).
7a. *S. yunnanensis* var. *Mairei.*
I. Cymes nearly or quite as long as the leaves, on long slender peduncles.
J. Cymes 3–4-flowered (Szechuan, Yunnan) ..... 15. *S. Schumanniana.*
J. Cymes 6–20-flowered.
K. Cymes 4–6 cm. long (Hupeh).
15a. *S. Schumanniana* var. *pluriflora.*
K. Cymes 8–13 cm. long (Szechuan).
15b. *S. Schumanniana* var. *longipes.*
E. Disc smooth, without longitudinal ribs.
F. Disc with five indurated disciform glands.
G. Glands equatorial.
H. Leaves up to 9 × 3.5 cm. (Yunnan) ..... 16. *S. glandulosa.*
H. Leaves at most 6 × 2 cm. (Yunnan) ..... 17. *S. angustifolia.*
G. Glands basal; leaves up to 11 × 4 cm. (Shensi) ..... 18. *S. shensiensis.*
G. Glands marginal; leaves up to 7 × 2.5 cm.
H. Leaves membranaceous, pale and subglaucous beneath, up to 5 × 1.5 cm. (Yunnan) ..... 19. *S. bicolor.*
H. Leaves chartaceous, up to 7 × 2.5 cm., subconcolorous, but if paler beneath never subglaucous (Yunnan) ..... 20. *S. callosa.*
F. Disc without indurated disciform glands (Yunnan) ..... 21. *S. pallida.*
A. Disc more or less shallowly cup-shaped, not conspicuously turgid or swollen and not much thickened, its margin irregularly or regularly shallowly to deeply toothed or lobed, never annular and entire ..... Sect. Odontodiscus.
B. Older branches with few to many thickened, short, indurated, spine-like structures subtending the branchlets and sometimes the leaves or flowers, the flowers precocious, appearing before the leaves.
C. Ovaries pubescent (Japan, Kiangsu, Anhwei, Chekiang, Fukien, Kwangtung, Kwangsi, Hunan, Kiangsi) ..... 22. *S. japonica.*
C. Ovaries glabrous (Kwangtung, Kiangsi) ..... 22a. *S. japonica* var. *sinensis.*
B. Plants wholly unarmed, deciduous and with coetaneous leaves and flowers, or evergreen.
C. Flowers in simple, axillary, solitary or fascicled racemes, never in cymules (Borneo).
23. *S. racemosa.*
C. Flowers variously arranged, but never in simple racemes.
D. Flowers axillary, solitary, or sometimes two or more together, but never in simple or compound cymes or cymules, or in compound inflorescences.
E. Petals 10–12 mm. long, green (Nepal) ..... 24. *S. campanulata.*
E. Petals smaller, never exceeding 8 mm. in length, green to purple.
F. Evergreen; petals oblong to oblong-lanceolate (Malay Peninsula, Sumatra).
25. *S. sumatrana.*
F. Deciduous.
G. Flowers greenish purple or green; petals more or less narrowed upward; filaments up to 5 mm. long, not widened below; styles 4–5 mm. long (Sikkim, Bhotan) ..... 26. *S. leptandra.*
G. Flowers purple; petals broadly obovate and broadly rounded; filaments 3–4 mm. long, widened below; styles 2.5–3 mm. long (Kashmir to Sikkim and Nepal) ..... 24. *S. campanulata.*
D. Flowers in few- to many-flowered cymes, the cymes strictly simple, solitary, or the cymules arranged in compound inflorescences.
E. Sepals very unequal, thin.
F. Flowers small, crowded in small 8–10-flowered cymes about 1 cm. in diameter; stamens 0.5–1 mm. long; leaves up to 6 cm. long (Yunnan) .. 27. *S. dumicola.*

F. Flowers larger; cymes 2-flowered; stamens 3–4 mm. long; leaves up to 9 cm. long (Hunan) .....28. *S. heterosepala.*

E. Sepals equal.

F. Flowers relatively large, longer; stamens 4–6 mm. and styles 4–5 mm. long; inflorescences branched from base, cymose-paniculate; leaves coriaceous to subcoriaceous; evergreen (Burma, Tonkin, Yunnan, Kwangsi, Kwangtung). 29. *S. fasciculata.*

F. Flowers mostly small; stamens and styles short, never more than 2.5 mm. long, often 1 mm. or less.

G. Flowers in small, solitary, few-flowered, simple cymes or umbels.

H. Leaves conspicuously pubescent beneath; petals always gradually and rather strongly narrowed upward.

I. Leaves mostly less than 1.5 cm. wide (Kweichow, Szechuan). 30. *S. gracilis.*

I. Leaves 2–5 cm. wide.

J. Leaf-bases mostly acute (Formosa, Chekiang, Fukien, Kwangtung, Hupeh, Hunan, Kwangsi, Kweichow, Kiangsi) .....31. *S. Swinhoei.*

J. Leaf-bases rounded.

K. Inflorescences and calyces pubescent (Hupeh, Chekiang, Kwangsi). 31a. *S. Swinhoei* var. *subcorymbosa.*

K. Inflorescences and calyces glabrous (Hainan). 31b. *S. Swinhoei* var. *hainanensis.*

H. Leaves glabrous beneath; petals various.

I. Leaves glaucous beneath in strong contrast to the dark-colored upper surface (Chekiang, Fukien, Kwangtung, Kiangsi) .....32. *S. discolor.*

I. Leaves sometimes pale beneath but never glaucous, lower and upper surfaces mostly subconcolorous.

J. Leaves coriaceous, rather rigid (Fukien, Kwangtung). 33. *S. coriacea.*

J. Leaves membranaceous to chartaceous, not rigid.

K. Deciduous; petals triangular-ovate, much narrowed upward to the obtuse tip (Himalayan region) .....34. *S. purpurea.*

K. Evergreen; petals (as far as known) not strongly narrowed upward, oblong, elliptic or obovate, broadly rounded to obtuse.

L. Leaves conspicuously falcate-acuminate (Burma)..35. *S. falcata.*

L. Leaves acute to acuminate, the acumen usually straight, not falcate.

M. Cymes in the axils of greatly reduced leaves and arranged on an elongated leafy branchlet from the axils of normal leaves, these flower-bearing and leafy branchlets longer than the normal leaves (Southern India) .....36. *S. malabarica.*

M. Cymes in the axils of normal leaves.

N. Leaves 3–8 cm. long.

O. Petals usually persisting at the base of the distinctly scrobiculate carpidia; leaves 4.5 cm. long or less (Yunnan). 37. *S. parvifolia.*

O. Petals not persisting at the base of the scrobiculate or non-scrobiculate carpidia.

P. Carpidia non-scrobiculate; leaves acute to obtuse at the base, distinctly reticulate beneath (Yunnan). 38. *S. acuminata.*

P. Carpidia prominently scrobiculate; leaves mostly broadly rounded at the base, very obscurely reticulate beneath.

Q. Pedicels at most 5 mm. long (Kweichow, Kwangsi). 39. *S. brevipetiolata.*

Q. Pedicels 10–15 mm. long (Kwangsi) ...40. *S. Wangii.*

N. Leaves up to 12–14 cm. long, varying from 6 to 14 cm. in length.

O. Leaves lanceolate; the scrobiculate carpidia at maturity more or less brown-pustular (Kweichow, Yunnan). 41. *S. Dielsii.*

O. Leaves elliptic-ovate to ovate-lanceolate; the scrobiculate carpidia never brown-pustular (Yunnan, Tonkin).
42. *S. olacifolia.*

G. Flowers in more or less compound inflorescences, the cymules mostly few-flowered, variously arranged in small to large inflorescences.

H. Branchlets densely tomentose; leaves more or less tomentose or pubescent beneath, at least on the midrib and nerves.

I. Disc-lobes tipped by small indurated glands; pedicels and branchlets of the inflorescence glabrous; petals small (ex Hooker f. less than 1 mm. long) (India, and probably from Assam) .....43. *S. tomentosa.*

I. Disc-lobes without indurated glands; pedicels and branchlets of the inflorescence pubescent; petals about 3 mm. long (Upper Burma).
44. *S. Wardii.*

H. Branchlets glabrous or only sparingly pubescent; leaves glabrous on both surfaces.

I. Petals 3.5–5 mm. long, these and the sepals, filaments, and ovaries minutely reddish-punctate; carpidia up to 1.2 cm. long, pyriform, much narrowed below, very obscurely scrobiculate (Bengal, Silhet, Assam, Manipur) .....45. *S. lanceolata.*

I. Petals mostly 2–3 mm. long, the floral parts not reddish-punctate, or if so the punctations obscure; carpidia obovate, obovate-reniform, or orbicular, never pyriform, mostly prominently scrobiculate.

J. Flowers usually numerous or very numerous, the cymules racemosely arranged in relatively narrow racemiform-paniculate or paniculate inflorescences, the inflorescences often as long as the leaves.

K. Lateral cymes of the inflorescences always compound (Northern India to Upper Burma) .....46. *S. paniculata.*

K. Lateral cymes of the inflorescences always simple.

L. Stamens distinctly unequal; petals 1.5–2 mm. long; inflorescences often with small scattered leaves; normal leaves coriaceous.

M. Inflorescences glabrous (Northern India, Burma, Siam, Malay Peninsula, Sumatra, Yunnan) .....47. *S. limoniacea.*

M. Inflorescences sparingly pubescent (Fukien, Kwangtung, Hainan, Kwangsi) .....47a. *S. limoniacea* var. *ardisioides.*

L. Stamens equal; petals 2.5–3 mm. long; inflorescences never leafy; leaves chartaceous.

M. Inflorescences pubescent (Sumatra, Java, Borneo).
48. *S. javanica.*

M. Inflorescences glabrous (Sumatra, Java).
48a. *S. javanica* var. *glabriuscula.*

J. Flowers relatively few, in solitary compound or subdecompound axillary cymes, or if the cymules are racemosely arranged, then both cymules and flowers very few in number and the uppermost flowers in the inflorescence often racemose, the inflorescences usually much shorter than the leaves.

K. Cymules few and few-flowered, arranged in rather short narrow racemiform panicles, or the uppermost flowers actually racemose.

L. Sepals and pedicels sparingly but distinctly pubescent; stamens 1.5–1.8 mm. long (Moluccas, New Guinea, Solomon Islands).
49. *S. pauciflora.*

L. Sepals pubescent only on their margins; pedicels glabrous; stamens 0.5–1 mm. long (Philippines) .....50. *S. reticulata.*

K. Flowers in open, lax, compound or decompound, axillary, solitary, peduncled cymes, the cymes or cymules never arranged in panicles.

L. Petals 3.5–4 mm. long; disc-lobes terminated by indurated glands; leaves shining on both surfaces (Upper Burma).
51. *S. kachinica.*

L. Petals mostly 2–3 mm. long; disc-lobes without indurated glands; leaves dull or only slightly shining.

M. Styles well developed, at least 0.5 mm. long; filaments mostly 1.5–2 mm. long.

N. Inflorescences glabrous.
O. Leaves with 5–7 or rarely 8 pairs of lateral nerves, mostly less than 10 cm. long (Himalayan region, Yunnan, Kweichow, Kwangsi, Indo-China, Borneo) ....52. *S. parviflora.*
O. Leaves with 8–10 pairs of lateral nerves, mostly 12–18 cm. long (Siam, Burma, Yunnan, Kweichow).
52a. *S. parviflora* var. *nitidissima.*
N. Inflorescences sparingly pubescent (Yunnan, Indo-China, Siam, Borneo) .....52b. *S. parviflora* var. *Harmandiana.*
M. Styles almost wholly lacking, or, if evident at all, not more than 0.2 mm. long; filaments 1–1.5 mm. long (Philippines).
53. *S. philippinensis.*

Sect. Pachydiscus (p. 15)

1. **Sabia transarisanensis** Hayata, Ic. Pl. Form. **5**: 31. *t. 5.* 1915; Sasaki, List Pl. Form. 278. 1928; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 704. 1931; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 459. 1936.

"Frutex scandentissimus plus minus volubilis; rami teretes in vivo virides, medulla solida, cortice laevi haud vel tenuissime lenticellato elevato-ruguloso glaberrimo, cicatricibus foliorum elevatis semi-rotundatis, 1½ mm. latis, ramuli gracillimi hornotini foliati basi perulis triangularibus subrotundatis 1 mm. longis ciliatis 2–3-seriatim dispositis et cataphyllis binis obovato-spatulatis 8 mm. longis suffultis. Folia membranacea alterna ovato-oblonga vel oblonga 4 cm.–6 cm. longa 18 mm.–30 mm. lata apice acuta vel breve acuminata ad summum obtusa basi obtusa vel acuta margine tenuiter cartilagineo-marginata obscure denticulata, denticulis minutis apice ciliolatis, membranacea supra in vivo pallido-viridia subtus pallidissimo-cinerea, nervis venis venulis rubro-coloratis subtus distincte reticulatis tenuissimis, utraque pagine glabra, costis venisque utraque pagine haud vel vix elevatis subplanis, costa flexuosa haud recta, venis lateralibus primariis utroque latere costae 5–6 arcuatis, mediis basi angulo 50° a costa egressis, venulis grosse reticulatis, petiolis 4–6 mm. longis rubescentibus, stipulis nullis. Flores ad axillas foliorum ramulorum hortoniorum [hornotinorum] solitarii vel gemini longe pedicellati, pedunculis ad axillas semper solitariis ebracteatis gracilibus glaberrimis 1 cm. longis vel apice furcatim 1-plo ramosis, ramis vel pedicellis pedunculo brevioribus a se angulo 90° egressis 5–6 mm. longis, vel pedunculis simplicibus haud ramosis florem singulum gerentibus. Sepala 5 viridia subaequalia oblonga 2 cm. [mm.] longa 1–1½ mm. lata apice obtusissima basi vix vel haud contracta paralleliter multi-nervia glaberrima. Petala 5–6 subpatentia fusco-purpurascentia oblongo-quadrangularia 5 mm. longa 2½ mm. lata apice rotundata basi haud contracta ad insertionem 2 mm. lata glabra sub-5-nervia margine integra. Stamina 5–6 petalo breviora glabra; filamentis 2½ mm. longis leviter dorso complanatis subteretibus, antheris rotundatis minus quam 1 mm. latis longisque utrinque emarginatis 2-locularibus, loculis valvis singulis dehiscentibus. Discus pulviniformis sub ovario situs leviter 5-lobatus ⅓ mm. altus. Ovarium globoso-conicum ½ mm. longum totiusque latum glabrum laeve 2-loculare, loculis 2-ovulatis, apice ad stylum abeuns, stylo validiusculo basi cum ovariis aequilato 3½ mm. longo columniformi glabro apice punctiformi stigmatoso, stigmate punctiformi minuto.

Hab. M. Arisan Tozan, leg. B. Hayata et Takeo Ito, Aprili. 1914.

Very distinct for its small thin leaves not exceeding 5 cm. in length."

A sterile specimen, *Wilson 10936* (A), from near the type locality, Arisan to Mount Morrison, altitude 2833–3333 m., probably represents this species, but its leaves are 4–9 cm. long and 2–3.5 cm. wide; *Wilson 10035* (A) from Nanto to Noko via Musha, also named *Sabia transarisanensis* Hayata, is also sterile, consisting only of leafless branches. I am unable to add anything to the original description and have seen no flowers or fruit of this species.

2. **Sabia emarginata** Lecomte, Bull. Soc. Bot. France **54**: 673. 1907; Rehd. & Wils. in Sargent, Pl. Wils. **2**: 196. 1914; Hand.-Maz. Symb. Sin. **7**: 644. 1933.

A deciduous suberect shrub, the branches and branchlets yellowish green (at least when young), slender, terete, striate, glabrous; bud-scales glabrous, ovate, the margins eciliate; leaves (very immature) oblong-lanceolate to oblong-elliptic, 2–3 cm. long, 1–1.5 cm. wide, acute at apex, acute to obtuse at base, membranaceous, glabrous and olivaceous on both surfaces, the margins not ciliate; nerves 5 pairs, slender, curved-ascending, arched and joined by means of the secondary nerves, slender, distinct, elevated on the lower surface, the reticulations somewhat obscure; petioles 2–3 mm. long, glabrous; inflorescences axillary, solitary, 1–1.5 cm. long, glabrous, mostly 2-flowered, sometimes 1-flowered, the peduncles somewhat glaucous, 1 cm. long; pedicels 2–4 mm. long; bracteoles caducous; flowers maroon, 6–8 mm. in diameter; calyx unequally 5-lobed, glabrous, the lobes thin, irregular, subobovate to oblong, 1.7–2 mm. long, 1–2 mm. wide, some of them distinctly emarginate, others rounded, the margins eciliate; petals 5, equal, thin, suborbicular-obovate, 3–4 mm. long and wide, 3–5-nerved, broadly rounded, the margins eciliate; stamens 5, equal; filaments slender, 2 mm. long, glabrous; anthers oblong, 0.8 mm. long, introrse; disc tumid, with 2 or 3 obscure projecting ribs, each rib bearing a very minute obscure indurated gland on its edge, the margin slightly undulate; ovary subconical or ovoid, glabrous; styles 4 mm. long, glabrous; stigmas minute, rounded; carpidia unknown.

China: Hupeh, south of Patung, *A. Henry 5314* (photo of type N, isotype G, N), March, flowers maroon.

Distribution: China (Hupeh).

This species is characterized by its thin, relatively large but very irregular subovate to oblong calyx-lobes, some of which are distinctly emarginate at their apices, other rounded. The type material is very inadequate, the leaves being very immature. Lecomte's description of the anthers as "ovatis, magnis (5–6 mm.)" is a palpable error; certainly 0.5–0.6 mm. was intended.

Rehder and Wilson, in Sargent, Pl. Wils. 2: 196. 1914, referred *Wilson 1728* from Kuling, Kiangsi, to this species with some doubt; its branches and branchlets are dark brownish purple, not pale greenish as in the type. It is a fruiting specimen and is hence not directly comparable with Lecomte's type. While the structure of the disc suggests *Sabia emarginata* Lecomte, the sepals are unfortunately fallen. It may or may not belong here. Its characters are not included in the description given above.

3. **Sabia pubescens** sp. nov.

Frutex scandens, deciduus, ramis pallide viridibus, teretibus, striatis, glabris; ramulis viridibus vel pallide brunneis, teretibus, gracilibus, striatis, sparse pubescentibus; perulis glabris, ovatis, margine ciliatis; foliis valde immaturis oblongo-lanceolatis, 1.5–3 cm. longis, 0.5–1 cm. latis, breviter acuminatis, basi obtusis, membranaceis, utrinque praesertim ad costam nervosque distincte pubescentibus; nervis 5 utrinque, subadscendentibus, curvatis, arcuato-anastomosantibus, subtus leviter elevatis, supra obscuris, venulis laxe reticulatis; petiolo pubescente, 5–8 mm. longo; inflorescentiis cymosis, 1.5 cm. longis, pubescentibus, 2–3-floris; pedunculis pubescentibus, circiter 8 mm. longis; pedicellis gracilibus, 3 mm. longis; bracteolis puberulis, linearibus, 2 mm. longis; floribus 10 mm. diametro; calycibus glabris, lobis aequalibus, ovatis, 1 mm. longis, acutis vel obtusis, margine minute erosulis, eciliatis; petalis 5, aequalibus, obovatis, 5 mm. longis, 3 mm. latis, late rotundatis, 5–6-nerviis, obtusis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis, gracilibus, 3–5 mm. longis, glabris; antheris oblongis, 1 mm. longis, extrorsis; disco tumido, costulato, costulis 3,

prominentibus, singulem glandulam minutissimam obscuram induratam in partibus medianis gerentibus, margine undulatis; ovario ovoideo, sparse puberulo vel glabro; stylis 3–4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, without locality, *T. T. Yü 5231*, type (A), in 1938, without notes.
Distribution: China (Yunnan).

This species is characterized by its pubescence, its 2- or 3-flowered short cymes, and its 3-ribbed tumid disc, each rib being supplied with a very obscure and minute indurated gland about halfway up.

4. **Sabia Rockii** sp. nov.

Frutex deciduus, suberectus vel scandens, 2–3 mm. altus, ramis purpureo-brunneis vel olivaceo-brunneis, teretibus, lenticellatis, glabris; ramulis pallide viridibus vel brunneis, gracilibus, obscure striatis, glabris; perulis glabris, late ovatis, acutis, margine ciliatis; foliis novellis lanceolatis, 3–3.5 cm. longis, 1 cm. latis, acutis, basi late acutis vel rotundatis, membranaceis, supra sparse minute pubescentibus, subtus glabris, margine scariosis, brevissime ciliatis; nervis 5 utrinque, gracilibus, curvato-adscendentibus, arcuato-anastomosantibus, utrinque cum venulis laxe reticulatis sat distinctis; petiolo 3 mm. longo, pubescente; inflorescentiis cymosis, 1.5 cm. longis, glabris, 2- vel 3-floris; pedunculis 3–5 mm. longis, gracilibus; pedicellis 5–7 mm. longis, gracilibus; bracteolis caducis; floribus 10 mm. diametro, purpureo-viridibus; calycibus glabris, lobis 5, aequalibus, subrotundatis vel late ovatis, 0.5 mm. longis, margine eciliatis; petalis 5, aequalibus, suborbicularibus vel late obovatis, latissime rotundatis, 5 mm. longis, 3–4 mm. latis, 7–9-nerviis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis linearibus, 2–4 mm. longis, glabris; antheris oblongis, 1 mm. longis, extrorsis; disco tumido, costulato, costulis 3–4 prominentibus, margine undulato vel crenato, glandulis induratis nullis; ovario ovoideo vel subconico, glabro; stylis 4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, eastern slopes of the Likiang Snow Range, Yangtze watershed, *J. F. Rock 8334*, type (A, C, U), alt. 2700–3000 m., flowers purplish green, 1923–24; Tchehai, *E. E. Maire 357* (A), alt. 2550 m., flowers dull violet; Tchou-tsin, *E. E. Maire 3320* (C), alt. 3000 m., flowers greenish.
Distribution: China (Yunnan).

This species seems to be similar to *Sabia Croizatiana* Chen, but it may be distinguished by its shorter peduncles and its ribbed tumid disc, which is without indurated glands. The flowers appear with the young leaves. *Maire 357* and *3320* represent a younger stage than the type collection.

5. **Sabia Ritchieae** Rehd. & Wils. in Sargent, Pl. Wils. **2**: 195. 1914, Jour. Arn. Arb. **9**: 91. 1928.

A deciduous scandent shrub, 2 m. high, the branches brown, stout, terete, flexuous, obscurely striate, lenticellate, glabrous, the branchlets greenish yellow, slender, terete, somewhat shiny; bud-scales glabrous, ovate, acute, the margins ciliate; very young parts sparsely pubescent, soon becoming glabrous; leaves elliptic-ovate or oblong-elliptic, 6–9 cm. long, 2–4 cm. wide, acuminate, broadly cuneate at base, subcoriaceous (immature ones membranaceous), somewhat glaucous, glabrous on both surfaces or sparsely pubescent along the midrib on the upper surface when young, dull on the upper surface, pale greenish yellow beneath, the margins very narrowly revolute, eciliate, or very shortly ciliate when young; nerves 3–5 pairs, arcuate-anastomosing, elevated, the veinlets loosely reticulate, conspicuous on the lower surface, obscure above; petioles of mature leaves 1.5 cm. long, glabrous, those of the young leaves 4–5 mm. long, minutely pubescent; inflorescences axillary, solitary, about 1–1.5 cm. long, 1-flowered;

peduncles at anthesis puberulent, 1–1.5 cm. long, in fruit clavate, glabrous, 2.5 cm. long; bracteoles none; flowers about 10 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes semiorbicular, 1 mm. long, obtuse, the margins ciliate; petals 5, equal, thin, obovate, broadly rounded, 5 mm. long, 2.5–3.5 mm. wide, 5–7-nerved, the nerves slender and obscure, the margins ciliate; stamens 5, subequal; filaments complanate, 1–2 mm. long, glabrous; anthers oblong, 1 mm. long; disc somewhat tumid, without projecting ribs, the margin annular or undulate, the indurated glands none; ovary conical or ovoid, glabrous; styles 3–4 mm. long, glabrous; stigmas minute, rounded; carpidia suborbicular, 8 mm. in diameter, glabrous, distinctly scrobiculate, without persistent petals at base.

China: Western Hupeh, Hsing-shan Hsien, *E. H. Wilson 2533,* type (A), May, 1907, alt. 900–1200 m., *2533* (in part), isotype (U); without locality, *A. Henry 6780* (G, N).

Distribution: China (Hupeh).

I judge that *Henry 6780,* a fruiting specimen, belongs here, and the description as above given is in part based on this collection. The type is a flowering specimen with immature leaves. Rehder & Wilson, Jour. Arnold Arb. **9**: 91. 1928, credit this species to Kansu on the basis of *Rock 12074.* This is a flowering specimen, the flowers appearing with the very young leaves. The petals are larger (6 × 5.5 mm.), the stamens much longer (5 mm.), while the disc is distinctly different. I am convinced that this and *Rock 24267* from Yunnan, in the same stage of development, represent an undescribed species, but it is inadvisable to characterize it until specimens with mature leaves are received.

6. **Sabia puberula** Rehd. & Wils. in Sargent, Pl. Wils. **2**: 197. 1914.

Apparently an evergreen scandent shrub, 0.5–2 m. high, the branches pale olivaceous to brown, terete, slender, striate, glabrous; branchlets pale olivaceous, terete, slender, obscurely striate, sparsely pubescent, becoming glabrous; bud-scales glabrous, ovate, acuminate, the margins ciliate; leaves oblong-lanceolate, ovate-oblong, or elliptic-oblong, 5–10 cm. long, 1.5–4 cm. wide, acuminate, acute to rounded at base, membranaceous when young, becoming chartaceous, glabrous on both surfaces except the midrib on the upper surface (which is obscurely pubescent in young leaves), dull green to olivaceous on the upper surface, paler beneath, the margins scarious or narrowly and thinly cartilagineous, finely erose, glabrous except when very young; nerves 4 or 5 pairs, slender, curved-ascending, arcuate-anastomosing, more or less elevated beneath, the veinlets loosely reticulate, prominent on the lower surface, somewhat obscure above; petioles 4–10 mm. long, slightly pubescent, becoming glabrous; inflorescences cymose, 3.5–4 cm. long, sparingly pubescent, 2–5-flowered; peduncles slender, 1–2.5 cm. long; pedicels somewhat filiform, 8 mm. long; bracteoles glabrous, lanceolate, 1 mm. long; flowers about 6–8 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes broadly ovate or suborbicular, 1 mm. long, obtuse, the margins ciliate; petals 5, equal, thin, minutely and obscurely reddish-glandular, ovate-elliptic, broadly rounded, 3–4 mm. long, 2–3 mm. wide, 5-nerved, the nerves rather prominent, the margins ciliate; stamens 5, equal; filaments subulate, 4 mm. long, glabrous; anthers ovoid, 0.5 mm. long, extrorse; disc tumid with 3 or 4 projecting ribs, each rib bearing a minute inconspicuous indurated gland at about the middle, the margin annular; ovary minutely pubescent, the styles exserted, 3 mm. long, sparingly pubescent; stigma minute, rounded; carpidia reddish brown, suborbicular, 7 mm. in diameter, glabrous, distinctly scrobiculate, without persistent petals at base.

China: Western Hupeh, Hsing-shan Hsien, *E. H. Wilson 2534a,* type (A), May–Sept., 1907, alt. 600–1300 m.; Fang Hsien, *E. H. Wilson 2534b* (A), Aug., 1907, 1050 m. alt.; without locality, *A. Henry 4045* (G); Szechuan, Nanchuan Hsien, *W. P. Fang 1388* (A), June 3, 1928, alt. 2500–2700 m.

Distribution: China (Hupeh, Szechuan).

This species was reduced by Rehder, Jour. Arn. Arb. **15**: 9. 1934, to the synonymy of *Sabia Dielsii* H. Lév. of Kweichow. It is distinguished from the latter by its minutely pubescent ovaries, sparingly pubescent styles, and its annular-margined disc, which is tumid and with three or four projecting longitudinal ribs, each with an inconspicuous indurated gland at about the middle. As I understand and interpret the species it is very closely allied to *Sabia yunnanensis* Franch.

6a. **Sabia puberula** Rehd. & Wils. var. **hupehensis** var. nov.

A typo differt pedunculis pedicellisque glabris.

China: Hupeh, without locality, *A. Henry 6290*, type (N), 1885–1888.

Distribution: China (Hupeh).

Differs from the typical form of this species in its glabrous peduncles and pedicels. Henry's specimen was originally determined as representing *Sabia yunnanensis* Franch.

7. **Sabia yunnanensis** Franch. Bull. Soc. Bot. **33**: 465. 1886, Pl. Delav. 147. 1889; Diels, Bot. Jahrb. **29**: 451. 1900; H. Lév. Cat. Pl. Yunnan 250. 1917; Hand.-Maz. Symb. Sin. **7**: 644. 1933.

Apparently a deciduous scandent shrub, 3–4 m. high, the branches pale olivaceous to dark brown, terete, slender, flexuous, striate, glabrous; branchlets pale brown, terete, slender, sparsely pubescent or glabrous; bud-scales minutely puberulent, broadly ovate, the margins ciliate; leaves lanceolate to ovate-lanceolate, or oblong-ovate, 4–7.5 cm. long, 1–3 cm. wide, acute or acuminate, shortly acute or rounded at base, membranous to subchartaceous, shortly pubescent or glabrous on both surfaces, olivaceous on the upper surface, pale green or almost glaucous beneath, the margins very narrowly cartilaginous, minutely erose and subciliate, the nerves 4–6 pairs, slender, curved-ascending, arched-anastomosing, beneath slightly to distinctly elevated, the veinlets manifest on the lower surface, obscure above; petioles 6–10 mm. long, sparsely pubescent; inflorescences cymose, 3–4 cm. long, sparsely pubescent or glabrous, 2–4-flowered; peduncles 2–3 cm. long, the pedicels 4–7 mm. long, thickened upwards; bracteoles glabrous, linear, 1.5 mm. long, the margins sparsely ciliate; flowers greenish to greenish yellow, 10 mm. in diameter; calyx 5-lobed, glabrous, the lobes ovate or subrounded, 1 mm. long, acute or obtuse, the margins scarious, obscurely subdenticulate, eciliate; petals 5, thin, broadly obovate to obovate-elliptic, broadly rounded, 5 mm. long, 3–4 mm. wide, 7–8-nerved, the margins eciliate; stamens 5, subequal; filaments linear, 3–4 mm. long, glabrous; anthers ovoid, 0.5 mm. long, extrorse; disc tumid, with 3 or 4 projecting ribs, each rib bearing a minute but distinct disciform indurated gland on the edge, at about the middle, the margin annular, slightly crenate or wavy; ovary shortly but distinctly pubescent, conical, ovoid, or subpyramidal; styles 2.5 mm. long, glabrous, sometimes sparsely pubescent; stigmas minute, rounded; carpidia suborbicular or subreniform, 4–5 mm. in diameter, somewhat glaucous, glabrous, scrobiculations prominent, without persistent petals at the base.

China: Yunnan, western slope of the Likiang Snow Range, *J. F. Rock 4243* (A, C, U), May–June, 1922, alt. 3600–3900 m.; eastern slope of the Likiang Snow Range, *J. F. Rock 4793* (A, C, U), May–Oct., 1922; Tsanghan Range, near Lake Talifu, *Rock 3114* in part (A), April 15–25, 1922, *G. Forrest 2096* in part (A), May, 1906, alt. 2700–3000 m.; Likiang Hsien, *C. W. Wang 70703* (A), July, 1935, alt. 2700 m.; Bodo, southeast of Chungtien, *K. M. Feng 1065* (A), May 26, 1939; Hokin, near Sung-kwei, *K. M. Feng 792* (A), April 23, 1939; Tali Range, *G. Forrest 4721, 4726* (A), June–Aug., 1906, alt. 2400–3000 m.; Tali Hsien, *C. W. Wang 63080, 63084* (A), May, 1935, alt. 2400 m.; Tche-hai, *E. E. Maire 281* (A), April, alt. 2500 m.; Southern Szechuan, between Mo So Ying and Kung Mu Ying, *C. Schneider 637* (A); between Kalapa and Liuku, *C. Schneider 1261* (A, C), May

17, 1914; Southwestern Szechuan, Danfang, *Handel-Mazzetti 1066* (U), Apr. 1, 1914, alt. 1700 m. (as *S. Schumanniana* Diels); Ning Yüan Fu, *C. Schneider 998* (A, G), Apr. 23, 1914.

Distribution: China (Yunnan, Szechuan).

This species was originally described from Yunnan material, *Delavay 793, 2031*.[1] I have seen none of these specimens, but have interpreted the species from Franchet's description. It is possible, however, that more than one species may be represented among the three collections cited by him, as he speaks of the leaves and peduncles as sometimes glabrous and sometimes pubescent. In interpreting the species I have depended partly on his description of the ovary as "pyramidatum pilosulum," as this seems to be a good distinguishing character. A great many Yunnan collections have been identified as representing Franchet's species, but many of these clearly represent other than *Sabia yunnanensis* Fr. Apparently Franchet's material came from the vicinity of Talifu, as in the introduction to his "Plantae Delavayanae" he states that Delavay's headquarters were at Talifu. In interpreting the species I have given particular attention to those collections available to me that were made in the general vicinity of that place, including specimens from the eastern and western slopes of Likiang Snow Range. The specimens above referred to *Sabia yunnanensis* Franchet vary considerably in the size and shape of the leaves, but the pilose ovary and the tumid discs with 3 or 4 projecting ribs impress me as constant and significant characters. As here interpreted, *Sabia yunnanensis* Franch. is very close to *S. puberula* Rehd. & Wils.

7a. **Sabia yunnanensis** Franch. var. **Mairei** (H. Lév.) stat. nov.

Celastrus Mairei H. Lév. Repert. Sp. Nov. 13: 264. 1914.

A typo differt ovario glabro, foliis utrinque leviter consperse pubescentibus vel supra plus minusve pubescentibus et subtus glabris.

China: Yunnan, Lou-ke-suin, *E. E. Maire s.n.*, syntype of *Celastrus Mairei* H. Lév., fragments and photo. (A), alt. 3000 m.; Tong Tchou-an, *E. E. Maire s.n.*, syntype of *C. Mairei* H. Lév., fragment and photo. (A), alt. 2600 m.; drainage basin of Lake Talifu, Tsangshan Range, *J. F. Rock 3114* in part (A), April 13, 1922, *3120* (N, U), alt. 2500 m., April 13–25, 1922; Hokin, Shiang-shu-ho by Ma-erh-shan near Sung-kwei, *K. M. Feng 746* (A), April 20, 1939; southeast of Hokin, on the way from Chiang-Ing to Domei on the Yangtze banks, *K. M. Feng 817* (A), April 25, 1939; eastern slopes of the Likiang Snow Range, *J. F. Rock 3531* (A, C, U), flowers greenish with a purplish tinge, *3672* (A, C, N, U), flowers green, alt. 3000–3600 m., *3732* (A, C, U), May–Oct., 1922, *G. Forrest 5574* (U), alt. 2700–3000 m., May, 1910; Likiang Hsien, *C. W. Wang 70719* (A), alt. 2700 m., July, 1935; Northwest Likiang, Chiao-tou on the Yangtze, *R. C. Ching 20685* (A), May 19, 1939; southeast of Chungtien, *K. M. Feng 962* (A), May 22, 1939; Kouty near Pin-tchouan, *F. Ducloux 117* (C, N), April, 1907, *S. Ten 544* (A, U), in 1918; Tchou-uen-tsen, *E. E. Maire 541* (A), alt. 2550 m.; without locality, *H. T. Tsai 57011* (A), in 1934, *T. T. Yü 15500* (A), in 1938, *E. E. Maire 1489* (U).

Distribution: China (Yunnan).

Celastrus Mairei H. Lév. was reduced by Diels, according to Loesener, Ber. Deutsch. Bot. Ges. 32: 543. 1914, to *Sabia yunnanensis* Franch., but it seems to differ from that species in its glabrous ovaries and in its leaves either more or less pubescent on both surfaces or pubescent on the upper surface and glabrous beneath. The specimens cited above differ considerably in leaf-shape, but the

[1] No. 793 from Pee-cha-ho mountains, near Mo-so-yn, and 2031 from Mao-kow-tchang, near Tapin-tze; three years later Franchet added *Delavay 149* from Ta-long-tan, near Tapin-tze, all Yunnan localities. The one altitude given is 2300 m. *Schneider 637*, cited above, is labelled as from Mo-so-ying and Kung-mu-ying, southern Szechuan.

ovary is constantly glabrous, which convinces me that but a single entity is involved.

8. **Sabia latifolia** Rehd. & Wils. in Sargent, Pl. Wils. **2**: 195. 1914; Stapf, Bot. Mag. **146**: *t. 8859*. 1920; Rehd. & Wils. Jour. Arn. Arb. **8**: 164. 1927; Hand.-Maz. Symb. Sin. **7**: 644. 1933.

An evergreen, scandent shrub, about 2–3 m. high, the branches dull green to brownish purple, terete, lenticellate, flexuous, glabrous; branchlets greenish yellow, terete, striate, sparingly pubescent; bud-scales broadly ovate, pubescent or sparsely pubescent, the margins ciliate; leaves elliptic-oblong or elliptic, rarely ovate, 5–14 cm. long, 2–7 cm. wide, usually short-acuminate, cuneate to broadly acute or even subtruncate-rounded at base, membranaceous (when young) to chartaceous, green to olivaceous, very sparsely pubescent, becoming glabrous on the upper surface, paler beneath and with widely spaced short hairs from slightly thickened bases on the nerves beneath, the margins scarious, obscurely ciliate, becoming glabrous; nerves 5 pairs, curved-ascending, arcuate-anastomosing, distinct above, beneath in mature leaves strongly raised, with the reticulations prominent on the lower surface; petioles 0.7–2 cm. long, somewhat pubescent, becoming glabrous; inflorescences cymose, 3–4.5 cm. long, sparsely pubescent, mostly 3-flowered; peduncles 2–3 cm. long; pedicels 4–5 mm. long, slightly thickened upwards; bracteoles caducous; flowers 8–10 mm. in diameter; calyx equally 5-lobed, sparsely pubescent, the lobes suborbicular, rarely broadly ovate, 0.5 mm. long, obtuse or acute, the margins minutely erose, sparsely ciliate; petals 5, thin, elliptic-ovate to obovate, 4–5 mm. long, 3–4 mm. wide, usually broadly rounded, 5–7-nerved, the margins ciliate; stamens 5, subequal; filaments flat, narrowed upward, 3–5 mm. long, glabrous; anthers ovoid, 1 mm. long, introrse; disc tumid with 3 or 4 slightly projecting ribs, the margin slightly undulate, the indurated glands none; ovary ovoid or conical, pubescent to sparsely pubescent; styles 4 mm. long, glabrous; stigmas minute, rounded; mature carpidia blue (when fresh), subreniform, 7–8 mm. in diameter, glabrous, the scrobiculations distinct, without persistent petals at the base.

China: Western Szechuan, Wa-shan, *E. H. Wilson 818*, type (A), isotype (G, U), *2530* (A, U); southeast of Tachien-lu, *E. H. Wilson 2531* (A, U), in thickets, alt. 1200–2250 m., flowers greenish, June and August, 1908.

Distribution: China (Szechuan).

This species is allied to *Sabia yunnanensis* Franchet of Yunnan, but is distinguished by its tumid disc with slightly projecting ribs without indurated glands, while the stamens are introrsely antheriferous. Rehder, Jour. Arnold Arb. 8: 164. 1927, records this species from Anhwei on the basis of *Steward 1168*, but I refer this specimen to *Sabia* sp.

9. **Sabia Yuii** sp. nov.

Frutex sempervirens, ut videtur scandens vel subscandens, 2–3 m. altus, ramis subgriseis, sublenticellatis, teretibus, subflexuosis, glabris; ramulis brunneis vel subviridibus, striatis, glabris; perulis glabris, ovatis, acuminatis, margine minutissime ciliatis; foliis subchartaceis, plerumque oblongo-ovatis, 6–9 cm. longis, 2.5–5 cm. latis, acuminatis, basi late truncato-rotundatis vel truncato-subcordatis, utrinque glabris, supra olivaceo-brunneis, subtus pallidis, margine anguste scarioso-cartilagineis, eciliatis; nervis 5 vel 6 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, supra obscuris, subtus elevatis, perspicuis, venulis laxe reticulatis; petiolo 7–10 mm. longo, consperse pubescente vel glabro; inflorescentiis axillaribus, solitariis, cymosis, 2.5–4 cm. longis, glabris, 2–4-floris; pedunculis circiter 2 cm. longis; pedicellis 5–10 mm. longis; bracteolis glabris, linearibus, 1–1.5 mm. longis, margine minutissime ciliatis; floribus pallide viridibus, 10 mm. diametro; calycibus aequaliter 5-lobatis, lobis ovatis, 0.5 mm. longis,

obtusis vel rotundatis, margine sparse minutissime ciliatis; petalis 5, aequalibus, membranaceis, saepe deorsum in partibus medianis minute rubro-punctatis, plerumque late obovatis, rotundatis, 5 mm. longis, 4 mm. latis, 7-nerviis, margine minutissime ciliatis; staminibus 5, inaequalibus; filamentis complanatis, minutissime rubro-punctatis, sursum angustatis, 2–2.5 mm. longis, glabris; antheris oblongis, 1 mm. longis, extrorsis; disco tumido, 4-costulato, eglanduloso, margine annulari vel obscure undulato; ovario subconico vel ovoideo, glabro; stylis circiter 3 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, Shunning, Snow Range, *T. T. Yü 15975,* type (A), May 26, 1938, alt. 3000 m., a rare shrub, 5–10 feet high, in thickets, flowers pale green.

Distribution: China (Yunnan).

This is characterized by its broadly truncate-rounded or truncate-subcordate leaf-bases and its minutely but noticeable ciliate-margined petals.

10. **Sabia gaultheriifolia** Stapf in herb. sp. nov.

Sabia gaultherifolia Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5:** 78. 1936, in clavis Japonice, *nomen nudum.*

Frutex scandens, sempervirens, ramis subcinereis vel atro-brunneis, teretibus, glabris; ramulis pallide viridibus vel pallide olivaceis, teretibus, striatis, glabris; perulis sparse pubescentibus vel glabrescentibus, late ovatis, margine ciliatis; foliis oblongo-ovatis, oblongis, vel oblongo-subellipticis, 6–11 cm. longis, 2–4 cm. latis, acuminatis vel subacutis, basi late acutis vel obtusis, chartaceis, utrinque glabris, supra olivaceis vel brunneis, subtus pallidioribus, margine angustissime cartilagineis, eciliatis; nervis 4 vel 5 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, supra haud perspicuis, subtus distinctis elevatis, secundariis reticulisque manifestis; petiolo circiter 1 cm. longo, glabro; floribus (haud visis) axillaribus terminalibusque solitariis, pedicellis sub fructu 2.5–5.5 cm. longis, glabris, sursum incrassatis; bracteolis nullis; sepalis sub fructu glabris, aequalibus, ovatis vel triangularibus, circiter 1 mm. longis, obtusis vel rotundatis, margine eciliatis; disco subannulari, longitudinaliter distincte 5-costulato, incrassato, margine indurato, subtruncato, vel obscure undulato, glandulis induratis nullis; ovario ovoideo, glabro; stylis 3–4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis suborbicularibus vel subreniformibus, circiter 7 mm. diametro, glabris, scrobiculatis, primo rubris, maturis azureis, petalis ad basim haud persistentibus.

China: Hupeh, Chang-yang, *A. Henry 6227,* type (G, U), *6022* (G); Patung, *Henry 7298* (K, photo. N); Kiangsi, Lushan Mountain, *H. H. Chung & S. C. Sun 627, 735* (A, N), July–Aug., 1935, alt. 700–800 m.; Fukien, Buong Kang, Yenping, *H. H. Chung 3409* (A, C), June 15, 1925, alt. 500 m., fruit first red then blue when ripe; Chekiang, Chen Chiong, south of Siachu, *R. C. Ching 1764* (U), May–Sept., 1924, alt. 850 m.; Southern Chekiang, region of King Yuan, *R. C. Ching 2391* (A, U), Aug.–Sept., 1924, alt. 1100 m., fruit blue when mature; without locality, *R. C. Ching s.n.* (A).

Distribution: China (Hupeh, Kiangsi, Fukien, Chekiang).

At Kew there are two sheets representing three collections in the *Sabia gaultheriifolia* cover, *Henry 6227* from Chang-yang, *Henry 7298* from Patung, and *Henry 3126* from Ichang, all in Hupeh Province; *Henry 6022* from Hupeh was placed by Stapf in the *Sabia sinensis* cover, but I believe it to be referable to *S. gaultheriifolia* Stapf. In separating *S. gaultheriifolia* and *S. sinensis,* Stapf gives the following key characters: "nervation sharply prominent on both sides, branches dark, then grey, leaves acutely acuminate.....*gaultheriifolia,*" and "nervation less markedly prominent, branches remaining green a long time; blades subacuminate, not very acute.....*sinensis.*" The only specimen in the *Sabia sinensis* cover that has its "blades subacuminate, not very acute" is *Tutcher 10862A* of which I have an excellent photograph kindly sent by Dr.

A. D. Cotton. I interpret this as the type of *S. sinensis* Stapf and have placed this as a variety of *Sabia japonica* Maxim. *Sabia gaultheriifolia* Stapf may be distinguished by its distinct and prominent reticulations on the lower surface of the leaves. The indicated disc characters are taken from fruiting specimens, and flowers are as yet unknown. I take the species to be a representative of the section *Pachydiscus*.

11. **Sabia Metcalfiana** sp. nov.

Frutex sempervirens, scandens, ramis ramulisque brunneis vel purpureo-brunneis, teretibus, striatis, glabris; perulis sparse pubescentibus vel glabris, lanceolatis, margine ciliatis; foliis oblongo-ovatis, 7–12 cm. longis, 3–6 cm. latis, longe acute acuminatis, basi rotundatis vel late acutis, chartaceis vel subcoriaceis, utrinque glabris, nitidis, supra olivaceis vel brunneis, subtus pallidioribus, margine anguste cartilagineis, leviter revolutis, eciliatis; nervis 4 vel 5 utrinque, gracilibus, curvatis, arcuato-anastomosantibus, subtus distincte elevatis, venulis manifestis, supra obscuris; petiolo 1–1.5 cm. longo, glabro; inflorescentiis axillaribus, solitariis, brevissime (1–2 mm.) pedunculatis, 4- vel 5-floris, sub anthesi folia parva (ad 1.5 cm. longa) gerentibus, axibus 3–7 mm. longis, floribus ut videtur viridibus, depauperato-racemosim dispositis; pedicellis filiformibus, 1.5–2 cm. longis; bracteolis nullis; floribus 8 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, circiter 1 mm. longis, acutis, margine erosulis, eciliatis; petalis 5, aequalibus, membranaceis, obscure obovatis, late rotundatis, 4 mm. longis, 3 mm. latis, 5-nerviis, nervis distinctis, margine eciliatis; staminibus 5, aequalibus; filamentis linearibus 3–4 mm. longis, glabris; antheris ovoideis, 1 mm. longis, extrorsis; disco subcylindraceo, sub anthesi haud incrassato, longitudinaliter obscure 5-costato, truncato vel obscure subcrenulato, glandulis induratis nullis; ovario ovoideo, glabro; stylis exsertis, filiformibus, 5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, Lung-ling Hsien, *H. T. Tsai 54582* (A), *55007,* type (A), Jan. 6–7, 1934, alt. 2200–2400 m., a scandent shrub in ravines, flowers apparently green.

Distribution: China (Yunnan).

The inflorescences are axillary and solitary, the axis being but 3–7 mm. long, and at anthesis bearing a few thin small leaves which subtend the flowers and which apparently do not persist, the inflorescence being a depauperate raceme rather than a cyme, the slender pedicels elongating after anthesis and apparently most of the small leaves falling. Tsai's note on his number *55007* is "flower green" and that on number *54582* is "flower purple," but the two numbers seem safely to represent a single species. The disc is not as strongly developed as in other species of the section *Pachydiscus,* yet I feel confident that it belongs here. Dedicated to Professor Franklin P. Metcalf of Lingnan University, Canton, China.

12. **Sabia pentadenia** sp. nov.

Frutex scandens videtur sempervirens, ramis atropurpureis vel pallide flavido-viridibus, teretibus, substriatis, lenticellatis, glabris; ramulis pallide olivaceis vel viridi-flavidis vel flavidis, teretibus, striatis, glabris; perulis minute obscure puberulis, ovatis, acuminatis, margine brevissime ciliatis; foliis ovatis vel oblongo-ovatis, 5.5–8 cm. longis, 2–3 cm. latis, perspicue acute acuminatis, basi late rotundato-truncatis vel subcordatis, coriaceis, utrinque nitidis, supra pallide viridibus, subtus pallidioribus, glabris, margine cartilagineis, eciliatis, anguste revolutis; nervis utrinque 5, gracilibus, arcuato-anastomosantibus, supra obscuris, subtus elevatis; petiolo circiter 5 mm. longo, glabro; inflorescentiis axillaribus, solitariis, 3–4 cm. longis, glabris, 1- vel 2-floris; pedunculis gracilibus, circiter 2.5 cm. longis; pedicellis subclavatis, circiter 1 cm. longis; bracteolis caducis;

floribus 10 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, circiter 1 mm. longis, obtusis, margine leviter ciliatis; petalis 5, aequalibus, subchartaceis, deorsum obscurissime minute punctato-glandulosis, late obovatis, 5 mm. longis, 5 mm. latis, apice late rotundatis, 7-nerviis; staminibus 5, subaequalibus; filamentis 3–4 mm. longis, sursum angustatis glabris, deorsum minutissime obscure rubro-glandulosis; antheris oblongis, 1 mm. longis, introrsis; disco tumido, leviter et late 5-costulato, margine undulato, glandulis 5 conspicuis induratis parvis disciformibus; ovario ovoideo, glabro; stylis circiter 4 mm. longis, minutissime rubro-glandulosis, glabris; stigmatibus minutis, rotundatis; carpidiis subreniformibus vel suborbicularibus, 5–6 mm. diametro, glabris, scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, without locality or notes, *H. T. Tsai 62875* (A), type, 1934.
Distribution: China (Yunnan).

This species can be distinguished by its five small prominent indurated glands spaced at regular intervals on the undulate margin of the somewhat 5-ribbed tumid disc.

13. **Sabia Croizatiana** sp. nov.

Frutex sempervirens vel deciduus?, scandens, ramis flavo-viridibus vel purpureo-brunneis, teretibus, flexuosis, striatis, glabris; ramulis pallide viridibus, teretibus, gracilibus, striatis, glabris; perulis glabris, ovatis vel lanceolatis, margine ciliatis; foliis parvis, oblongo-lanceolatis vel anguste oblongo-ellipticis, 2.5–4.5 cm. raro 5 cm. longis, 5–10 mm. raro 15 mm. latis, acutis vel breviter acute acuminatis, basi late acutis obtusis vel subrotundatis, membranaceis vel chartaceis, utrinque glabris, supra plerumque olivaceis, subtus pallidis, subcinereis vel subglaucis, margine scarioso-subcartilagineis, angustissime revolutis; nervis 4 vel 5 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, gracilibus, subtus leviter elevatis, venulis laxe reticulatis, supra obscuris; petiolo 2–4 mm. longo, gracili, glabro; inflorescentiis cymosis, circiter 1–2 cm. longis, glabris, 2–4-floris; pedunculis filiformibus, circiter 10–12 mm. longis; pedicellis filiformibus, 2–5 mm. longis; floribus viridibus vel flavido-viridibus, 8 mm. diametro; calycibus glabris, lobis 5, aequalibus, minute obscurissime rubro-punctículatis, ovatis, circiter 1 mm. longis, obtusis, margine eciliatis; petalis 5, aequalibus, membranaceis, deorsum vel in partibus medianis minute obscure punctato-glandulosis, oblongo-ellipticis vel late ellipticis vel obovatis, late rotundatis, circiter 4–5 mm. longis, 1.5–4 mm. latis, circiter 7-nerviis, margine eciliatis; staminibus 5, inaequalibus; filamentis 2–4 mm. longis, complanatis, sursum angustatis, glabris; antheris oblongis, 0.5 mm. longis, extrorsis; disco tumido, costulato, costulis 5, prominentibus, in partibus medianis glandula minutissima disciformi indurata praeditis, margine annularibus; ovario ovoideo, glabro; stylis circiter 2.5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, Tché-Ky, *E. E. Maire 326,* type (A), *335* (A), May, flowers greenish yellow, alt. 2990 m.; Siao-ho, *E. E. Maire 3639* (C, N, U), flowers yellowish, May, 1910, alt. 2000 m.; Sou-pin-Chao, *S. Ten 357* (A, C, U), April 19, 1917, flowers green; Tali Shan, *G. Forrest 19379* (A, U), May, 1921, alt. 3000–3300 m., flowers green; Tali Range, *G. Forrest 4707* (A), alt. 2700–3000 m.; Eastern Likiang, Tze-li, *R. C. Ching 20231* (A), April 27, 1939, flowers yellowish green; Chung-tien, *J. F. Rock 24718* (A, C, N, U), April to May, 1932, flowers yellow, alt. 3600 m., in cane-brake spruce forest; Kien-shuei Hsien, *H. T. Tsai 53037* (A), April 8, 1933, alt. 1900 m., flowers green.
Distribution: China (Yunnan).

This species is very similar to *Sabia yunnanensis* Fr. var. *Mairei* (H. Lév.) Chen, and like the latter has glabrous ovaries and tumid ribbed discs, each rib bearing a minute but noticeable disciform indurated gland about halfway up. With strong transmitted light and a reasonably high magnification, the sepals and the basal (or median) parts of the petals appear characteristically but minutely reddish-punctate-glandular. The leaves are consistently smaller than

in *Sabia yunnanensis* var. *Mairei*. The new species is named in honor of Dr. Leon Croizat, of the Arnold Arboretum, Harvard University.

14. **Sabia omeiensis** Stapf in herb. sp. nov.

Sabia omeiensis Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 77. 1936, in clavis Japonice, *nomen nudum*.

Frutex suberectus videtur deciduus, ramis nigris, teretibus, flexuosis, striatis, lenticellatis, glabris; ramulis nigris vel pallide olivaceis, teretibus, gracilibus, leviter flexuosis, obscure striatis, glabris; perulis glabris, ovatis, acutis, margine ciliatis; foliis ellipticis vel oblongo-ellipticis, 3–9 cm. longis, 1.5–4 cm. latis, acutis vel breviter acuminatis, basi obtusis vel rotundatis, membranaceis, utrinque glabris, supra atro-olivaceis, subtus paullo pallidioribus, margine eciliatis angustissime cartilagineis; nervis 5 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, subtus elevatis, supra obscuris, venulis laxe reticulatis; petiolo 5–10 mm. longo, glabro; inflorescentiis cymosis, 2–4 cm. longis, glabris, 2- vel 3-floris; pedunculis gracilibus, 1–2 cm. longis; pedicellis 5–10 mm. longis; bracteolis caducis; floribus circiter 10 mm. diametro, plerumque pallide rubro-viridibus vel purpureo-viridibus; calycibus glabris, lobis 5, aequalibus, triangulari-ovatis, 1 mm. longis, acutis, margine eciliatis; petalis 5, aequalibus, elliptico-obovatis, 5 mm. longis, 3–3.5 mm. latis, late rotundatis, 5-nerviis, nervis perspicuis, margine sparse ciliatis; staminibus 5, inaequalibus; filamentis complanatis, 3–4 mm. longis, glabris; antheris ovoideis, 1 mm. longis, extrorsis; disco tumido, longitudinaliter 3-costulato, in partibus medianis glandula minutissima indurata obscure praedito, margine annulari vel undulato; ovario ovoideo vel subconico, glabro; stylis circiter 3 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Szechuan, Mount Omei (Omei Shan), *E. H. Wilson, Veitch Exped. 4713*, type (K) frustulum (A) photo. (N), *T. T. Yü 382* (A), April 18, 1932, alt. 1850 m., scandent, in woods, flowers purplish red; O-pien-Hsien, *T. T. Yü 613, 662, 779* (A), May 3–16, 1932, alt. 2200 m., shrub five feet, in woods, flowers reddish green; west of Kuan Hsien, *F. T. Wang 20846* (A), May 15, 1930, alt. 2260 m., shrub eight feet, on slope in thickets.

Distribution: China (Szechuan).

Doctor Stapf named this species, basing it wholly on *Wilson 4713* (Veitch Exp.), this specimen at Kew bearing the name *Sabia omeiensis* in Stapf's handwriting. Of this I have seen a single flower courteously sent by Dr. A. D. Cotton of the Royal Botanic Gardens, Kew. The floral characters of *Wilson 4713* closely approximate those of the several specimens listed above. There is considerable variation in the shape and size of the leaves among the specimens cited, but this is apparently due to varying stages of development.

15. **Sabia Schumanniana** Diels, Bot. Jahrb. **29**: 451. 1900; Rehd. & Wils. in Sargent, Pl. Wils. **2**: 196. 1914; Hand.-Maz. Symb. Sin. **7**: 643. 1933.

An evergreen, scandent shrub, 2–3 m. high; branches and branchlets olivaceous to pale yellowish green, slender, terete, striate, glabrous or when young sparingly pubescent; bud-scales glabrous, ovate, the margin ciliate; leaves lanceolate or oblong-lanceolate, 5–12 cm. long, 1.5–2.5 cm. (rarely 3 cm.) wide, acute or shortly acuminate, rounded or acute at base, chartaceous or when young membranaceous, above pale to greenish olivaceous, glabrous on both surfaces when mature, shiny, sometimes sparsely pubescent on the midrib and the lateral nerves above, somewhat paler beneath, the margins scarious or narrowly cartilagineous, minutely erose, eciliate; nerves 4 or 5 pairs, slender, curved-ascending and joined by means of the secondary veins near the margin, elevated, the reticulations distinct on both surfaces; petiole 3–6 mm. long, glabrous or occasionally with a few hairs on margins; inflorescences cymose, 4–6 cm. long, sparsely and obscurely pubescent or glabrous, 2–4-flowered; peduncles filiform, 2–4 cm. long;

pedicels filiform, 0.5–1.5 cm. long; bracteoles glabrous, narrowly lanceolate, 1–2 mm. long; flowers 8–10 mm. in diameter, green; calyx equally 5-lobed, glabrous, the lobes ovate or broadly ovate, about 1 mm. long, acute or obtuse, the margin subciliate or eciliate; petals 5, equal, thin, suborbicular to broadly obovate, broadly rounded, 4–5 mm. long, 4–4.5 mm. wide, 5–7-nerved, the margins subciliate; stamens 5, subequal; filaments complanate, 2.5–4.5 mm. long, glabrous; anthers ovoid, 1 mm. long, extrorse; disc tumid, with 4 narrow not prominent ribs, the margin annular or slightly wavy, the indurated glands none; ovary ovoid, glabrous; styles 4 mm. long, glabrous; stigmas minute, rounded; carpidia at first red, then blue, suborbicular or subreniform, about 5 mm. in diameter, glabrous, distinctly scrobiculate, without persistent petals at the base.

China: Hupeh, Patung Hsien, *H. C. Chow 313, 323, 654* (A, N), May and June, 1934; without locality, *A. Henry 5421, 6114* (G, U); Szechuan, Nan Ch'uan, *C. Bock & von Rosthorn 2026* iso-syntype (fragment and photo. A); Wa-shan, *E. H. Wilson 860* (A, U), alt. 1200–1800 m., July and September, 1908; Ma-pien Hsien, *F. T. Wang 23045* (A), May 28, 1931, alt. 2000 m.; without locality, *Henry 7240* (G), *5421B* (G, N); Yunnan, Yong Shan Hsien, *H. T. Tsai 50982* (A), June 2, 1932, alt. 2100 m.; without locality, *E. E. Maire s.n.* (A).

Distribution: China (Hupeh, Szechuan, Yunnan).

This species is characterized by its narrow leaves and by its long and slenderly peduncled 2–4-flowered inflorescences, the flowers being subumbellately arranged, their pedicels very unequal in length. There are no indurated glands on the disc. *Chow 313* and *Henry 5421* and *5421B* have somewhat smaller leaves than the other cited specimens, but I find no floral or fruit characters by which these can be distinguished from the typical form.

15a. **Sabia Schumanniana** Diels var. **pluriflora** Rehd. & Wils. in Sargent, Pl. Wils. 2: 197. 1914, excl. *Henry 5421, 5421B, 6114.*

Differs from the typical form of this species particularly by its 6–20-flowered cymes.

China: Western Hupeh, Hsing-shan Hsien, *E. H. Wilson 2534,* type (A), flowers brownish chocolate, alt. 900–1800 m., May 6, 1907; without locality, *E. H. Wilson 582* (N), May, 1900.

Distribution: China (Hupeh).

15b. **Sabia Schumanniana** Diels var. **longipes** Rehd. & Wils. in Sargent, Pl. Wils. 2: 197. 1914.

Differs from the preceding variety by its longer leaves (up to 20 cm. long), and its much longer, much more lax inflorescences, their peduncles being 6 to 9 cm. long.

China: Western Szechuan, Chin-ting-shan, *E. H. Wilson 2529,* type (A), alt. 1300 m., May 22, 1908, flowers greenish purple; Kuan Hsien, *W. P. Fang 2178* (A), July 13, 1928.

Distribution: China (Szechuan).

These two varieties are clearly not strong ones, but both the one from Hupeh and the other from Szechuan differ from the species notably in their much more numerous flowers. I note no essential floral differences between these and the species. Additional collections may indicate the desirability of some other disposition of them.

16. **Sabia glandulosa** sp. nov.

Frutex sempervirens, scandens, 2 m. altus, ramis ramulisque pallide vel atro-viridibus, teretibus, gracilibus, striatis, glabris; perulis glabris, ovatis, acuminatis, margine ciliatis; foliis oblongo-ovatis, 5–9.5 cm. longis, 2.5–3 cm. latis, graciliter longe subfalcato-acuminatis, basi obtusis vel subrotundatis, chartaceis, supra nitidis, subatro-olivaceis, conspersissime breviter pubescentibus glabrescentibus,

subtus pallide viridibus, nitidis, glabris vel secus costam nervosque parcissime breviter subsetoso-pubescentibus, margine subcartilagineis erosulis, junioribus breviter ciliatis, vetustioribus glabris; nervis primariis 4 vel 5 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, subtus elevatis, distinctis, venulis sublaxe reticulatis, manifestis; petiolo 5–10 mm. longo, glabro vel sparse pubescente; inflorescentiis cymosis, circiter 3.5 cm. longis, glabris, 2- vel 3-floris; pedunculis gracilibus, 1.5 cm. longis, pedicellis subclavatis, 1 cm. longis; bracteolis glabrescentibus, linearibus, 0.5 mm. longis; floribus ignotis; calycibus glabris, lobis 5, aequalibus, late ovatis vel ovatis, 0.5 mm. longis, obtusis vel late obtusis; disco tumido, ecostulato, in partibus medianis glandulis 5 prominentibus parvis induratis disciformibus instructo, margine annulari vel undulato; ovario conico, glabro; stylis 4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, Southern Chungtien, Kung-shiang-shu, Snow Mountain, on the way to Kai-lou-wei on the banks of the Yangtze River, *K. M. Feng 1834*, type (A), July 25, 1939, alt. 2900 m., climber 2 m. high, on open thickets.

Distribution: China (Yunnan).

In vegetative characters and in its general appearance this species approximates *Sabia shensiensis* Chen, but is distinguished by its five small prominent disciform indurated glands, which are equatorially located on the tumid disc.

17. **Sabia angustifolia** sp. nov.

Frutex sempervirens (vel deciduus ?), scandens, 3–6 m. altus, ramis olivaceo-brunneis, teretibus, striatis, glabris; ramulis plerumque pallide viridibus, gracilibus, teretibus, leviter flexuosis, obscure striatis, consperse, patule et breviter pubescentibus; perulis pubescentibus, ovatis, margine ciliatis; foliis lanceolatis vel anguste ovato-lanceolatis, 4–7 cm. longis, 1–1.5 cm. latis, sursum sensim angustatis, apice acute acuminatis, basi late acutis vel obtusis, raro subrotundatis, firme membranaceis vel subchartaceis, supra olivaceo-viridibus, glabris vel parcissime pubescentibus, subtus pallidioribus, breviter obscure conspersissime puberulis glabrescentibus, margine scariosis, parcissime breviter ciliatis, nervis 4 vel 5 utrinque, gracilibus, curvato-adscendentibus, circiter ad marginem arcuato-anastomosantibus, gracilibus, subtus leviter elevatis, venulis laxe reticulatis, supra obscuris; petiolo 5 mm. longo, glabro vel conspersissime pubescente; inflorescentiis axillaribus, solitariis, glabris, cymosim 1- vel 2-floris; pedunculis gracilibus, 1.5–2 cm. longis; pedicellis sursum incrassatis, sub fructu circiter 1.5 cm. longis; bracteolis caducis; floribus ignotis; calycibus glabris, lobis 5, aequalibus, ovatis vel late ovatis, circiter 1 mm. longis, acutis vel obtusis, margine ciliatis; disco tumido, ecostulato, glandulis 5 minutis induratis disciformibus in partibus medianis ornato, margine annulari; ovario conico, glabro; stylis subulatis, 3.5 mm. longis, glabris; stigmatibus minutis, capitatis; carpidiis nitidis, nigris, suborbicularibus, circiter 5 mm. diametro, glabris, leviter scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, Chien-chuan-Mekong divide, *G. Forrest 21472*, type (A, U), July, 1922, alt. 9000 m., a scandent shrub 3–5 m. high, growing in thickets by streams, fruit black when dry (the note on the specimen in relation to the fruit is not very intelligible: "In fruit, fruits darkest"; they are probably dark blue when fresh).

Distribution: China (Yunnan).

This species is distinguished by its small lanceolate or narrowly ovate-lanceolate leaves and by its tumid not ribbed disc being supplied with five small indurated disciform glands spaced at regular intervals around its equatorial part.

18. **Sabia shensiensis** sp. nov.

Frutex, ut videtur sempervirens, erectus (vel scandens ?), ramis ramulisque pallide flavido-viridibus vel olivaceis, teretibus, striatis, glabris; perulis pubescen-

tibus, ovatis, acuminatis, margine ciliatis; foliis ellipticis vel lanceolatis, 3–11 cm. longis, 1.5–4 cm. latis, acutis vel breviter acuminatis, basi acutis, membranaceis vel chartaceo-membranaceis, utrinque conspersissime breviter subciliatis, supra viridibus, subtus pallidioribus, margine anguste scarioso-cartilagineis, erosulis, primo breviter ciliatis; nervis 4–6 utrinque, gracilibus, curvato-subadscendentibus, arcuato-anastomosantibus, supra obscuris, subtus perspicuis, elevatis, venulis ultimis subtus elevatis, sublaxe reticulatis; petiolo circiter 1 cm. longo, gracili, consperse ciliato; fructibus axillaribus, solitariis, pedicellis circiter 3 cm. longis, subclavatis, primo pilis paucis brevibus instructis glabrescentibus, circiter 3 cm. longis; bracteolis nullis; floribus ignotis; sepalis sub fructu glabris, lobis 5, aequalibus, subrotundatis, circiter 0.5 mm. longis, obtusis, margine eciliatis; disco tumido, ecostulato, ad basim glandulis 5 parvis induratis irregulariter disciformibus instructo, margine leviter undulato; ovario conico vel ovoideo, glabro; stylis 4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis leviter compressis, inaequilateraliter obovatis vel suborbicularibus, circiter 5 mm. diametro, glabris, scrobiculatis, petalis ad basim haud persistentibus.

China: Shensi, Tai-pei-shan, *W. Purdom 894*, type (A), in 1910, without notes.
Distribution: China (Shensi).

This species is distinguished from *Sabia glandulosa* Chen by its disc-glands being located near the base of the tumid disc.

19. **Sabia bicolor** sp. nov.

Frutex ut videtur sempervirens, scandens, ramis pallide viridibus vel subolivaceo- vel brunneo-viridibus, teretibus, flexuosis, striatis, glabris, ramulis pallide viridibus, teretibus, gracilibus, striatis, parcissime pubescentibus vel glabris; perulis glabris, ovatis, margine ciliatis; foliis lanceolatis vel oblongo-lanceolatis, 2.5–5 cm. longis, 0.8–1.5 cm. latis, acutis vel leviter acuminatis, basi subrotundatis vel obtusis, submembranaceis vel subchartaceis, supra olivaceis vel atro-olivaceis, sparse pubescentibus glabrescentibus, subtus pallidis, subglaucis, glabris, margine angustissime subscarioso-cartilagineis, primo breviter ciliatis, maturis eciliatis; nervis 3–5 utrinque, gracilibus, curvato-adscendentibus, arcuato-anastomosantibus, subtus leviter elevatis, venulis laxe reticulatis, supra obscuris; petiolo 2–5 mm. longo, gracili, sparse pubescente; inflorescentiis cymosis, 1–3 cm. longis, glabris, 2- vel 3-floris; pedunculis gracilibus, circiter 1–1.5 cm. longis; pedicellis gracilibus, 4–7 mm. longis, bracteolis caducis; floribus pallide viridibus vel albido-viridibus; calycibus glabris, lobis 5, aequalibus, triangulari-ovatis, circiter 0.5 mm. longis, acutis vel subacutis, margine erosulis, minutissime ciliatis; petalis 5, aequalibus, membranaceis, obovatis, suborbiculari-obovatis, vel obovato-ellipticis, 3–4 mm. longis, 2.5–3.5 mm. latis, 7- vel 8-nerviis, late rotundatis, margine eciliatis; staminibus 5, inaequalibus; filamentis 1.5–3.5 mm. longis, complanatis, glabris, sursum angustatis; antheris ovoideis, circiter 1 mm. longis, extrorsis; disco tumido, 5-costato, undulato, margine glandulis 5 parvis irregularibus disciformibus induratis ornato; ovario oblongo-ovoideo, glabro; stylis circiter 3 mm. longis, glabris; stigmatibus minutis, capitatis; carpidiis immaturis obovatis, deorsum inaequilateralibus, circiter 4 mm. diametro, distincte scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, Lao-ho-shan, Chen-kiang, *H. Wang 41415*, type (A), July 8, 1939, altitude apparently about 2600 m., a scandent shrub, fruit (immature) green; Chenkiang, *Y. Tsiang & H. Wang 16281* (A), alt. 1800–2000 m.; Kunming, *C. W. Wang 62809, 62818* (A), April, 1935, scandent on slopes, alt. 2000 m.; without locality, *Ducloux 6* (C).
Distribution: China (Yunnan).

This species may be recognized by its small, narrowly lanceolate or elliptic leaves which are sparsely pubescent on the midrib on the upper surface and glabrous and subglaucous beneath, and by its 5 minute indurated irregular disci-

form glands, which are spaced at regular intervals on the undulate margin of the tumid disc.

20. **Sabia callosa** sp. nov.

Frutex scandens ut videtur sempervirens, ramis plerumque olivaceo-brunneis, ramulis pallide olivaceis vel flavido-viridibus, teretibus, striatis, glabris; perulis glabris, late ovatis, margine ciliatis; foliis oblongis vel oblongo-ellipticis, 5–9 cm. longis, 1.5–2.5 cm. latis, plerumque perspicue acute acuminatis, basi late acutis vel subrotundatis, submembranaceis vel subchartaceis, supra olivaceis, subtus pallidioribus, utrinque glabris, margine anguste cartilagineis; nervis 4–6 utrinque, gracilibus, curvato-adscendentibus, arcuato-anastomosantibus, subtus elevatis, venulis laxe reticulatis, conspicuis, supra obscuris; petiolo 5–7 mm. longo, glabro vel junioribus obscure pubescente; inflorescentiis axillaribus, solitariis, 2–3 cm. longis, glabris, ut videtur 1- vel 2-floris; pedunculis gracilibus, 1 cm. longis; pedicellis sub fructu clavatis, 1–2 cm. longis; bracteolis caducis; floribus ignotis; calycibus glabris; lobis 5, aequalibus, late ovatis vel triangularibus, circiter 1 mm. longis, acutis vel obtusis, margine subciliatis; disco cyathiformi, lobulato, plerumque in partibus medianis glandulis 5 distinctis induratis disciformibus praedito, lobis 5, obtusis; ovario ovoideo, glabro; stylis 2.5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis suborbicularibus vel obovatis, 6–7 mm. diametro, glabris, distincte scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, without locality, *H. T. Tsai 57182, 57267* (A), *H. T. Tsai 57328,* type (A), in 1934, without notes; Li-kiang Hsien, *C. W. Wang 71317* (A), July, 1935, alt. 2800 m., on slopes.

Distribution: China (Yunnan).

This species may be recognized by the five rather prominent disciform indurated glands arranged at regular intervals on the sides of the disc.

21. **Sabia pallida** Stapf in herb. sp. nov.

Sabia pallida Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 78. 1936, *nomen nudum.*

Frutex sempervirens scandens, ramis ramulisque viridibus vel flavido-viridibus vel vetustioribus purpureo-brunneis, nitidis, teretibus, gracilibus, substriatis, glabris; perulis glabris, late ovatis, margine ciliatis; foliis oblongis, oblongo-ellipticis vel latissime oblongo-lanceolatis, 7.5–10 cm. longis, 2–4 cm. latis, acutis vel breviter acute acuminatis, basi obtusis, subrotundatis, vel late acutis, chartaceis vel submembranaceis, supra olivaceis, glabris (vel costa conspersissime pubescente), subtus cinereis, subglaucis, glabris; nervis 3–5 utrinque, gracilibus, curvato-adscendentibus, arcuato-anastomosantibus, subtus leviter elevatis, venulis laxe reticulatis, supra obscuris; petiolo 5–7 mm. longo, subglauco, glabro; inflorescentiis cymosis, 1–3 cm. longis, glabris, 3-floris; pedunculis filiformibus, 1–2.5 cm. longis; pedicellis subclavatis, circiter 5 mm. longis; bracteolis caducis; floribus atro-rubris, circiter 10 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, circiter 1 mm. longis, acutis vel obtusis, margine sparse ciliatis vel eciliatis; petalis 5, aequalibus, membranaceis, saepe deorsum in partibus medianis minute rubro-punctatis, plerumque late obovatis, latissime rotundatis, 4–5 mm. longis, 3.5–4 mm. latis, 7-nerviis, margine eciliatis; staminibus 5, inaequalibus; filamentis conspersissime minutissime rubro-punctatis, planis, sursum angustatis, 3–4 mm. longis, glabris; antheris minutis, ovoideis; disco tumido, ecostulato, eglanduloso, margine annulari vel obscure undulato; ovario subconico vel ovoideo, glabro; stylis circiter 4 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Yunnan, Mengtze, *A. Henry 10496* (A), *10529,* type (A, P, U), *10529A* (N), alt. 1800 m., scandent in forests, flowers dark red (*10529*) or greenish white (*10529A*).

Distribution: China (Yunnan).

The Henry specimens at Kew were all placed by Stapf in the *S. pallida* cover; they were previously referred to *Sabia yunnanensis* Franch., and they were also the basis of the Yunnan record of *Sabia discolor* Dunn by Merrill and Chun, Sunyatsenia **1**: 68. 1930. This species may be distinguished from *Sabia discolor* by its tumid disc, longer filaments, shorter petioles, and its 3-flowered cymes.

Sect. Odontodiscus (p. 15)

22. **Sabia japonica** Maxim. Bull. Acad. Sci. St. Pétersb. **11**: 430. 1867, Mél. Biol. **6**: 202. 1868, Bull. Soc. Nat. Moscou **54**: 7. 1879; Franch. Nouv. Arch. Mus. Hist. Nat. Paris **5**: 230. 1883; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 143. 1886; Makino, Futsu Shokubutsu Zufu (Icon. Comm. Pl.) **4**: *t. 290.* 1914; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 704. 1931; Honda, Shikisai Zuhan Zen-Shokubutsu Ziten (Concise Dict. Jap. Fl. Nat. Color) 151. *t. 563.* 1932; Murakoshi, Nai-gwai Shokubutsu Genshoku Dai Dzukan (Iconogr. Encyclop. Bot.) **5**: 47. no. 3187. 1935; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 458. 1936; Chen, Illus. Man. Chinese Trees & Shrubs. *726. f. 1–2.* 1937; Murakoshi, Shusei Shin-Shokubutsu Zukan (Illus. Jap. Fl.) *275. f. 1069.* 1937; Murakoshi, Genshoku Zusetsu Shokubutsu Daijiten (Compr. Bot. Illus. Dict.) 152–153. *t. 76, 3.* 1938; Terasaki, Nippon Shokubutsu Zufu Zoku-hen (Icon. Fl. Jap. Suppl. Vol.) *t. 2829.* 1938. **Fig. 1.**

Sabia Bullockii Hance, Jour. Bot. **16**: 9. 1878, **21**: 296. 1883.

Sabia sp. Rehd. & Wils. Jour. Arn. Arb. **8**: 164. 1927.

Sabia japonica Maxim. var. *spinosa* Lecomte, Bull. Soc. Bot. France **54**: 673. 1907, *in nota.*

Sabia spinosa Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 78. 1936, in clavis Japonice, *nomen nudum.*

A more or less scandent, occasionally suberect, deciduous shrub, the flowers always appearing before the leaves develop, the branches brown, gray or olivaceous, glabrous, the branchlets usually subtended by stout, indurated, straight or curved, short, spine-like processes (the indurated persistent bases of old petioles); branchlets usually unarmed, sometimes with short spines subtending the leaves, olivaceous to greenish yellow, slender, flexuous, glabrous or pubescent; bud-scales glabrous, ovate, obtuse, the margin eciliate; leaves oblong-lanceolate, ovate-lanceolate or broadly ovate, 3.5–9 cm. long, 2–4.5 cm. wide, shortly acute at apex, acute to subrotund and subequal at base, subchartaceous to chartaceous, usually olivaceous and glabrous on the upper surface, paler and glabrous to sparingly pubescent beneath, the margins slightly wavy, eciliate, slightly cartilagineous and narrowly revolute; nerves 4 or 5 pairs, slender, ascending, arched-anastomosing, elevated, the veinlets distinct on both surfaces; petioles 0.5–1.5 cm. long, pubescent or sparsely pubescent, sometimes obscurely glandular; flowers axillary, solitary or in pairs, subsessile or shortly pedicellate (3–5 mm.), the pedicels usually somewhat pubescent, the subtending scales 2–4 mm. long, nearly glabrous, the fruit sometimes borne on 2–4 mm. long axes or peduncles, the pedicels in fruit thickened upward, 2–2.5 cm. long, glabrous or pubescent; flowers pale greenish yellow, about 8 mm. in diameter; calyx equally 5-lobed, glabrous or sometimes with a few hairs, the lobes suborbicular, 0.5 mm. long, subacute or obtuse, the margins ciliate; petals 5, equal, thin, obovate to broadly oblong-obovate, broadly rounded, 3–4 mm. long, 2–2.5 mm. wide, 3–5-nerved, the nerves prominent; stamens 5, unequal; filaments 2–3 mm. long, glabrous; anthers ovoid, 0.4–0.5 mm. long, extrorse; disc somewhat cup-shaped, shallowly 5-lobed, the lobes obtuse, eglandular; ovary pubescent, ovoid to conical; styles cylindric, 2.5 mm. long, glabrous; stigma minute, rounded; carpidia suborbicular or subreniform, 5 mm. in diameter, sparsely pubescent, soon becoming glabrous, distinctly scrobiculate, dark blue when fresh, without persistent petals at the base.

JAPAN: Higo, *Herb. K. Sakurai s.n.* (A); Kyushu, *E. H. Wilson 6193* (A, G, U), *Z. Tashiro s.n.* (A), *Herb. K. Sakurai s.n.* (A); Satsuma, *U. S. Nat. Herb. 1179479* (U); Nagasaki, *Maximowicz, U. S. Nat. Herb. 19425,* ISOTYPE (U). CHINA: Kiangsu, I-hsing, *K. Ling, Herb. Univ. Nanking 12400* (C, G); Hai Wei, *Ching & Tso 496* (A); Paohwashan, *W. C. Cheng 4507* (U); Bau Hwa Shan, *E. D. Merrill 11438* (N); Chekiang, Chang-hsing, *K. Ling, Herb. Univ. Nanking 12426* (C); Mo Kan Shan, *Cheo & Wilson, Herb. Univ. Nanking 12823* (C, G, N); Chang-hua Hsien, *Y. L. Keng 565, 622* (A, C); without collector, *LU. 78106* (L); Fukien, *Dunn, Herb. Hongkong 2535* (A); Ku-Dien, *H. H. Chung 8023* (A, L, N), *8043* (A, L, N); Kwangtung, Tan Ha Shan, *K. P. To, CCC 2806* (P); Lung Tau Shan, *To, Tsang & Tsang, CCC 12787, 12847* (C, U); Kwangsi, Hang On-yuen, *T. S. Tsoong* (= Z. S. Chung) *81700* (A); Ta-chiang-yuen Village and vicinity, *W. T. Tsang 28146* (A); Hunan, Chang-ming Hsien, *C. S. Fan & Y. Y. Li 82* (A, B); Ping Tou Shan, *W. T. Tsang 23657* (A, U); Kiangsi, Siangtontou, Ling-shan, *Y. Tsiang 9952* (N); Oo Chi Shan, *S. K. Lau 4464* (A, U); Sui Chuen, *H. H. Hu 869* (A, P); Anhwei, Kimen, *Herb. Univ. Nanking 7825* (C); without locality, *K. K. Tsoong 3294 in part* (P) and *Herb. Univ. Nanking 1590* (P); Ningpo, *E. Faber s.n. in part* (N).

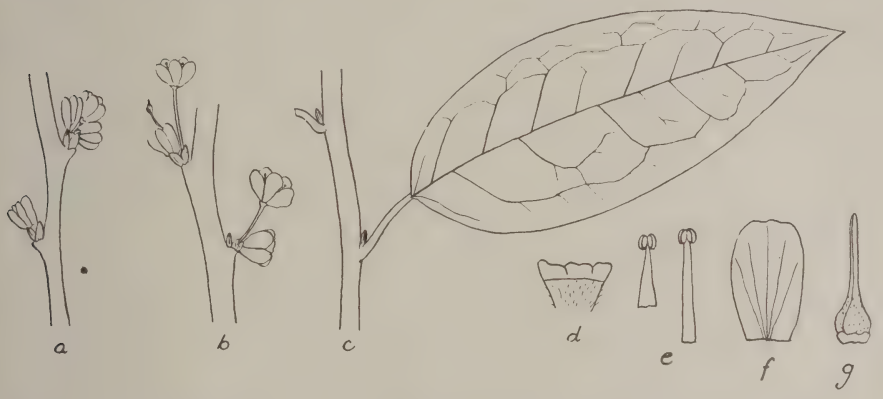

Fig. 1. *Sabia japonica* Maxim.; *a, b,* leaffless branches showing precocious flowers, × 1; *c,* a branch with a mature leaf, × 1; *d,* calyx, *e,* stamens, *f,* petal, and *g,* ovary, style and disc, all × 5.

DISTRIBUTION: Japan, China (Kiangsu, Chekiang, Fukien, Kwangtung, Kwangsi, Hunan, Kiangsi, Anhwei).

This species is characterized by being deciduous, the solitary or paired flowers appearing with the young leaves or before they develop, and by the spine-like thickened processes at the bases of many of the young branches and sometimes below leafless nodes. Of all the known species of the genus *Sabia*, this is the commonest and the most widely distributed one in eastern Asia, extending from Higo in Japan to Kiangsu, Chekiang, Fukien, Kwangtung, Kwangsi, Hunan, Kiangsi, and Anhwei in China. As is to be expected of any wide-ranging species, there is some variation in pubescence of both leaves and floral parts and in the size and shape of the leaves, but since I have not found any constant characters in the material at hand for separating specimens from different regions, I believe that only a single species is represented. Léveillé, Cat. Pl. Yun-Nan 250. 1917, records the species from Yunnan, but it is believed that this record was based on an erroneously identified specimen. This is the only spiny species in the genus, and Stapf had separated certain Chinese specimens in the Kew herbarium under *Sabia japonica* Maxim. var. *spinosa* Lecomte, Bull. Soc. Bot. France **54**: 673. 1907; he merely wrote the name *"spinosa"* on the cover, but

wrote no names on any of the herbarium sheets, and this binomial, erroneously credited to Dunn, was published in the Japanese key, Acta Phytotax. Geobot. **5**: 78. 1936. The contents of this cover are *Oldham 568,* Nagasaki, *E. H. Wilson 6193,* Kyushu, *E. H. Wilson* (Veitch Exped.) *53,* Nanto, *Fortune 7,* from "China," *Shearer s.n.,* Hankow, *Evrard s.n.,* Ningpo, and *Bullock 140,* Lushan, Kukiang. I would call special attention to the fact that an isotype of Maximowicz's species, from Nagasaki, Japan, in 1863, has a distinctly spiny and a spineless branch on the same sheet, and the two clearly represent a single entity; Maximowicz merely did not mention the spiny character in his very short diagnosis. The spines occur chiefly on the older branches, the young branchlets being mostly spineless. After studying all of the material I have above listed under *Sabia japonica* Maxim., I am of the opinion that only a single species is represented, although unfortunately I have seen but a single sheet with flowers from China.

22a. **Sabia japonica** Maxim. var. **sinensis** (Stapf) stat. nov.

Sabia sinensis Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 78. 1936, in clavis Japonice, *nomen nudum.*

A typo differt pedunculis glabris vel glabrescentibus; ovario glabro.

China: Kwangtung, North River Region, *Tutcher 10862A,* type (K, photo. A), April, 1911; Lok Chiong, *C. L. Tso 20930* (A, N), June 3, 1929; Yang Shan and vicinity, *T. M. Tsui 679* (A, B, C, N, P, U), July to September, 1932; Man Chi Shan, near the Kwangtung-Kiangsi-Hunan borders, *W. T. Tsang 26254* (A); Kiangsi, Sai Hang Cheung, *S. K. Lau 4152* (A, U).

Distribution: China (NW. Kwangtung, SW. Kiangsi).

The specimens from northwestern Kwangtung and southwestern Kiangsi differ from those from the coastal and southeastern part of Kwangtung in their glabrate to glabrous peduncles and the glabrous ovaries. Since the differences are only those of degree, it seems advisable to consider this merely as a variety. Stapf had indicated this entity in herb. Kew as a species, *Sabia sinensis* Stapf, there being three sheets in the cover, *Tutcher 10862A* and *Henry 5421C* and *6022,* of which only the first seems to agree with Stapf's key character, "blades subacuminate, not very acute." The last two I refer to *Sabia gaultheriifolia* Stapf, and I interpret the Tutcher specimen as the actual type of *S. sinensis* Stapf. None of the sheets was named by Stapf, the specific name being merely written on the specimen cover. It is believed that the Henry specimens were included in the cover because it was thought that they were nearer *S. sinensis* than any other species.

23. **Sabia racemosa** sp. nov. **Fig. 2.**

Frutex sempervirens scandens, ramis pallide brunneis, teretibus, leviter striatis, glabris vel obscurissime sparse pubescentibus; perulis pubescentibus, late ovatis, margine ciliatis; foliis late ellipticis, elliptico-ovatis, vel oblongis, 9.5–15 cm. longis, 4–8 cm. latis, brevissime acuminatis vel acutis, basi late acutis vel subrotundatis, firme chartaceis vel subcoriaceis, supra olivaceis, subnitidis, glabris, subtus subopacis, utrinque concoloribus vel subtus paullo pallidioribus, margine cartilagineis, anguste revolutis, subundulatis, eciliatis; nervis 5–7 utrinque, curvatis, arcuato-anastomosantibus, supra subimpressis, haud perspicuis, subtus elevatis, perspicuis, venulis laxe reticulatis, distinctis; petiolo 1–1.5 cm. longo, crasso, glabro vel subglabro; inflorescentiis axillaribus, simpliciter racemosis, 3–5 cm. longis; racemis solitariis vel fasciculatis, sparse pubescentibus; floribus numerosis, stricte racemosim dispositis, circiter 8 mm. diametro, pedicellis brevibus, 1–2 mm. longis, bracteolis caducis vel nullis; calycibus sparse pubescentibus,

lobis 5, aequalibus, ovatis vel triangularibus, circiter 0.2 mm. longis, acutis; petalis 5 vel 6, aequalibus, membranaceis, ovato-lanceolatis, circiter 5 mm. longis, 2 mm. latis, 5-nerviis, nervis rubris, distinctis, sursum longe angustatis, acutis vel acuminatis, margine eciliatis; staminibus 5 vel 6, aequalibus; filamentis complanatis, 1 mm. longis, glabris; antheris oblongis, 0.5 mm. longis, introrsis; disco cyathiformi, distincte lobato, lobis 5, acutis vel obtusis, glandulis induratis nullis; ovario ovoideo, glabro; stylis 0.5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis obovatis, subcompressis, scrobiculatis, latissime rotundatis, basi inaequilateraliter subacutis, circiter 1 cm. longis; carpidiis albidis vel roseis, inaequilateraliter obovoideis, leviter compressis, apice rotundatis, 10–12 mm. longis, 8–10 mm. latis, leviter scrobiculatis, petalis ad basim haud persistentibus.

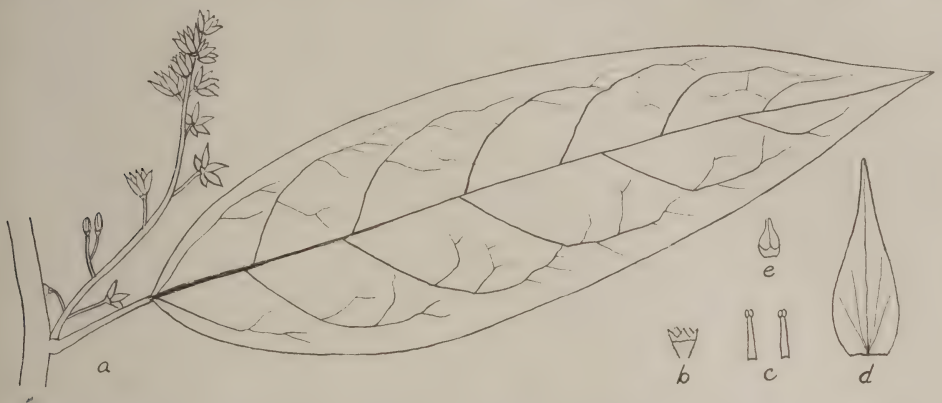

Fig. 2. *Sabia racemosa* Chen; *a*, a branch with leaf and raceme, × 1; *b*, calyx, *c*, stamens, *d*, petal, *e*, ovary, style and disc, all × 5.

Borneo: Southeastern Borneo, between Puimam and Salinahu, *Hubert Winkler 2948* (B) (*Herb. Hort. Bot. Bog. 940–5–78*), type, July 13, 1908; without notes, "N. Borneo" Oeloe Seboekoe, *Amdjah 484* (B) (*Herb. Hort. Bot. Bog. 940–5–8* and as "883 Herb. Hort. Bot. Bog.," originally named by H. Hallier as "*Sabia* sp." and probably from the Nieuwenhuis Expedition collections of 1893–1894, although at the bottom of the original label is written "a. 1912"; British North Borneo, Mount Kinabalu, Dallas, Tenompok, and Penibukan, *J. & M. S. Clemens 26192* (A, B), *30373* (A), *30374* (B), *30375* (B), *30631* (A, B, C), *32102* (B), Jan.–March, and Nov., 1932–33, alt. 900–1500 m., fruit white to pink.

Distribution: Borneo.

This is characterized by its many-flowered simple racemes, racemose flowers being a most unusual character in *Sabia*. The racemes are axillary and solitary or several in each axil. The flowers are rather numerous, sometimes somewhat crowded, while the ovate-lanceolate petals, 5 or 6 in number, are strongly narrowed upward to the acuminate tips. The short stamens are isomerous with the petals, but the sepals seem to be five only. In facies this species suggests *Sabia javanica* (Bl.) Backer, but its inflorescences are very different and it is totally different in its floral details.

24. **Sabia campanulata** Wall. in Roxb. Fl. Ind. **2**: 311. 1824; Spreng. Syst. Veg. **4**(2): Cur. Post. 91. 1827; Dietr. Syn. Pl. **1**: 804. 1839; Hook. f. and Th. Fl. Ind. **1**: 209. 1855; Walp. Ann. Bot. Syst. **4**: 138. 1857; Brandis, For. Fl. N.-W. Centr. Ind. 116. 1874; Hook. f. Fl. Brit. Ind. **2**: 1. 1879; Kanj. For. Fl. School Circ. N. W. Prov. 93. 1901, For. Fl. Siwalik Jaunsar United Prov. 121. 1911; Collett, Fl. Simlensis 101. 1921; Bamber, Pl. Punjab 607. 1916; Parker, For. Fl. Punjab 108. 1924; Osmaston, For. Fl. Kumaon 131. 1927.

A glabrous scandent deciduous shrub, the elongated branches and branchlets terete, striate, pale green or the older ones dark purple, the flowers appearing with the young leaves; buds ovate or lanceolate, glabrous, or the margins of the scales very shortly ciliate; young leaves subfasciculate, the mature ones oblong-lanceolate or narrowly elliptic-ovate, 4.5–12 cm. long, 2–3.5 cm. wide, mostly slenderly and sharply acuminate, acute at base, membranaceous to subchartaceous, green, somewhat paler beneath, the margins very narrowly subscarious-cartilagineous, glabrous or the very young ones slightly pubescent; primary nerves 3 or 4 on each side of the midrib, distinct, curved-anastomosing, elevated beneath, the secondary ones laxly reticulate; petioles 0.5–1 cm. long; flowers axillary, solitary or sometimes 2 or 3 together appearing with the young leaves, mostly reddish purple to purplish green, their pedicels slender, 5–8 mm. long, in fruit somewhat thickened upward and 1.5–4 cm. long; calyx equally 5-lobed, glabrous, the lobes ovate, 0.5 mm. long, obtuse, eciliate; petals 5, sometimes 4, equal or somewhat unequal, purple or greenish-purple, obovate, very broadly rounded, 7-nerved, eciliate, at full anthesis 4–5 mm. long and 3–4 mm. wide, sometimes persistent and increasing in size and up to 8 or even 10 mm. long as the fruits develop and then greenish; stamens 5, the filaments slightly unequal, flattened below, narrowed upward, 3–4 mm. long, glabrous; anthers ovoid, introrse; disc cup-shaped, slightly undulate-lobed, not ribbed, the indurated glands none; ovary ovoid, glabrous; style 2.5–3 mm. long, glabrous; carpidia suborbicular or broadly obovate, somewhat compressed, when fresh blue and apparently somewhat fleshy, 6–8 mm. in diameter, when dry distinctly scrobiculate, the petals subpersistent or not, when persisting then more or less accrescent and greenish.

India: Kashmir, below Aliabad, Poonch, *R. R. Stewart 12099* (N), April, 1931, alt. about 1800 m.; near Ramban, Jumu-Kashmir Road, *R. R. Stewart s.n.* (N), Sept., 1929, alt. 900 m.; Punjab, Dharmsala, *R. R. Stewart 2026* (N), May 26, 1917, alt. 1400 m.; Kajear to Chamba, *R. R. Stewart 2258* (A), sterile and with numerous lateral galls; Chamba, Kainthili Reserve, Perganna Chuari, and Chadbaint, Bhandal Valley, *R. N. Parker s.n.* (A), in flower, April 5, 1920, and just beyond anthesis, May 24, 1919, alt. 1900–2400 m.; Kulu, *W. Koelz 1470* (N), July 5, 1930, alt. 2300 m., *1775* (A, N, U), April 2, 1931, in pine forests, alt. 1800 m.; Simla District, *J. D. Drummond 2023, 21451* (C), *R. N. Parker s.n.* (A), June, 1908, alt. 2700 m., *T. Thomson s.n.* (G); Bhali, *R. N. Parker 3055* (A, C), June 15, 1928; United Provinces, Chakrata, *I. A. Qureshi 28* (C), in flower in April, in fruit in June; Mussourie, *R. R. Stewart 13112* (A), May, 1931, alt. 1950 m.; Kumaon, *Strachey & Winterbottom 1, 3* (G); Nepal, Doti District, *Bis Ram 364* (N), May 9, 1929, a climbing shrub; Sikkim, *J. D. Hooker s.n.* (C), alt. 2400–3000 m.

Distribution: India (Kashmir to Sikkim and Nepal).

The type of this species is *Wallich 1002* from Nepal, which I have not seen. When I first studied this assemblage I segregated the cited specimens as representing a distinct species, because Wallich originally described the petals as green and nearly half an inch long. In all the specimens I have examined I note no petals that exceed 5 mm. in length, and in all this material the flowers are distinctly purple, not green. I defer to the judgment of Mr. I. H. Burkill, who examined all the material at Kew, including Wallich's type number. He states that there are two Wallich sheets at Kew, one no. 1002A, the other no. 1002B; one of these bears a supplementary label indicating it as collected by Blinkworth in Kumaon. Assuming that the other is the Sheopore specimen, this shows what is needed, two twigs with very young leaves bearing purplish flowers with petals 4–5 mm. long, and a third twig with mature leaves and old flowers 10 mm. long. The petals persist and do not fall until the fruit matures. In none of the material that I have examined do the petals exceed 5 mm. in length, and although a number of collections bear fruit in various stages of development, there are no specimens with either persistent or accrescent petals represented.

25. **Sabia sumatrana** Blume, Mus. Bot. Ludg.-Bat. **1**: 370. 1851; Miq. Fl. Ind. Bat. **1**(2): 619. 1859, Illus. Fl. Archip. Ind. 72. 1870. *t. 33.* 1871; King, Jour. As. Soc. Bengal **65**(2): 454. 1896 (Mater. Fl. Malay. Pen. **2**: 740); Ridley, Fl. Malay Pen. **1**: 513. 1922.

An evergreen scandent shrub, the branches and branchlets brownish, terete, striate, glabrous; bud-scales lacking on all specimens examined; leaves ovate-lanceolate to elliptic or oblong-elliptic, 7–19 cm. long, 4–8 cm. wide, acute to slightly acuminate, acute to rounded at base, chartaceous, olivaceous to brownish olivaceous when dry, slightly paler beneath, glabrous on both surfaces, the margins eciliate, very narrowly revolute; nerves 5–7 pairs, strongly elevated and arched-anastomosing beneath, the reticulations rather lax and distinct or prominent beneath, somewhat obscure above; petioles 1–2.5 cm. long, somewhat wrinkled, glabrous; flowers axillary, solitary, white, 5-merous, their pedicels 1–1.5 cm. long, glabrous, rather stout in fruit; calyx equally 5-lobed, the lobes slightly pubescent, ovate, 1–1.5 mm. long, acute or obtuse, the margins ciliate; petals 5, oblong to oblong-lanceolate, 6–8 mm. long, 1–1.5 mm. wide, 5-nerved, acuminate, the margins eciliate; stamens 5, equal; filaments complanate, slightly swollen at apex, 3–4 mm. long, glabrous; anthers oblong, about 1 mm. long, introrse; disc somewhat cup-shaped, irregularly shallowly lobed, lobes 5, without indurated glands; ovary ovoid, glabrous; styles 4 mm. long, glabrous; stigmas minute, rounded; carpidia somewhat compressed, obovate to ovoid, about 10 mm. long and 8 mm. wide, glabrous, scrobiculate, without persistent petals at base, when fresh, blue with dark spots (King's collector says, "fruit white, blue spotted," and Ridley repeats this).

Sumatra: Without locality, *Korthals s.n.* (B); East Coast, Asahan, vicinity of Hoeta Bagasan, *R. S. Boeea 7127* (A, U), Sept., 1934 to Feb., 1935. Malay Peninsula: Perak, *King's collector 2217* (U), alt. 550 m., *Scortechini, U. S. Nat. Herb. no. 282062* (U), alt. 900 m.

Distribution: Sumatra, Malay Peninsula.

This species is recognized by its unusually long (6–7 mm.) narrowly lanceolate petals, its axillary solitary flowers, and its prominently nerved reasonably ample leaves. The Korthals specimen cited is probably an isotype; Blume cited no collector, merely stating: "In Sumatra." Miquel's excellent plate was doubtless based on the type collection.

26. **Sabia leptandra** Hook. f. & Th. Fl. Ind. **1**: 209. 1855; Walp. Ann. Bot. **4**: 138. 1857; Hook. f. Fl. Brit. Ind. **2**: 22. 1879.

Apparently a deciduous, scandent or subscandent shrub, the branches and branchlets terete, striate, glabrous; leaves oblong to ovate or elliptic-ovate, the smaller ones 3–8 cm. long and 1.5–3 cm. wide, the larger ones 11–16 cm. long and 4.5–7.5 cm. wide, acuminate, the base broadly acute to rounded, the younger ones membranaceous to subchartaceous, the mature larger ones subcoriaceous, glabrous on both surfaces, olivaceous to brown on the upper surface, pale beneath, the margins eciliate, slightly cartilagineous and revolute; nerves about 4 pairs, curved-ascending, anastomosing, prominently elevated on the lower surface, the secondary veins and lax reticulations distinct in the mature leaves, not so prominent in immature ones; petioles 5–8 mm. long on immature leaves, 1–1.8 cm. long on mature ones, glabrous; flowers axillary, solitary, the slender filiform pedicels 1.5–2 cm. long, in fruit slightly thickened upward and up to 2.5 cm. long; flowers 5-merous, greenish purple; calyx 5-lobed, glabrous, the lobes ovate or rounded, 0.4 mm. long, obtuse, the margins eciliate; petals 5, equal, thin, narrowly oblong-ovate, somewhat narrowed upward, at least 5–6 mm. long (about 8 mm. fide Hooker f. and Thomson), 2–2.5 mm. wide, obtuse, the margins eciliate; stamens 5, equal, the filaments linear, about 5 mm. long; anthers somewhat ovoid, 0.8 mm. long; disc cup-shaped, irregularly or regularly 5-lobed, the

lobes obtuse, without indurated glands; ovary glabrous, conical or ovoid; styles slender, 4–5 mm. long, glabrous; stigmas minute, subcapitate; carpidia subreniform, about 5 mm. in diameter, glabrous, the scrobiculations obscure, the petals not persistent at base.

India: Sikkim, *J. D. Hooker s.n.*, isotype (G), alt. 1500–2100 m., *T. Thomson s.n.* (B), in 1857, *G. King s.n.* (P), alt. 1700 m., *G. King 5105* (U), alt. 2100 m., *s.n.* (P), alt. 1500 m., *W. G. Craib 496* (P), Dec. 2, 1908, alt. 1400 m., *E. H. Wilson s.n.* (A), Sept. 10, 1921, *Herb. S. Kurz s.n.* (B), *Otto Kuntze 6830* (N), Nov. 21, 1874, alt. 1400 m., and without collector and number (B); Bhotan, Kalimpong, *C. B. Clarke 26433C* (B), Nov. 18, 1875, alt. 1400 m.

Distribution: India (Sikkim, Bhotan).

This species is distinguished by its elongated slender stamens, the disc being irregularly or regularly deeply lobed. One might suspect that the small and large leaves which Hooker f. and Thomson described might have come from at least separate plants, but this does not seem to be the case, judging from the Hooker, one Kurz, and one King specimen I have seen, while *Craib 496* consists of leafy branches bearing the larger mature leaves and flowers and leafless branches, and one bearing also immature leaves, both bearing more or less numerous flowers. I have seen no note indicating the exact habit of the species, but it seems safely to be deciduous and at least subscandent. Otto Kuntze indicates its size as 8–10 ft.

Diels, Bot. Jahrb. **29**: 451. 1900, recorded this species with some doubt from Szechuan, on the basis of *Rosthorn 16,* stating that Rosthorn's sterile specimen from Kin Shan belonged at least in the vicinity of *Sabia leptandra* Hook. f. & Th. I have seen no material from China that I can refer to that species and believe that it must be eliminated from the Chinese list.

27. **Sabia dumicola** W. W. Smith, Notes Bot. Gard. Edinb. **10**: 63. 1917. **Fig. 3.**

A deciduous shrub, 2–6 m. high, erect or subscandent, the branches and branchlets brownish olivaceous to greenish, terete, striate, glabrous; bud-scales glabrous, ovate, the margins ciliate; leaves ovate-lanceolate to oblong-lanceolate, 3–6 cm. long, 1.5–3 cm. wide, narrowed upward, acute or acuminate, the base cuneate or rounded, the immature ones membranous, at maturity subchartaceous, glabrous on both surfaces, olivaceous on the upper surface, pale green beneath, the margins narrowly cartilagineous and eciliate; nerves 4 pairs, arcuate-anastomosing, curved, slightly elevated, the veinlets loosely reticulate, inconspicuous; petioles 3–4 mm. long, glabrous; inflorescences cymose, 1–2 cm. long, glabrous, 8–10-flowered, the flowers somewhat crowded, the flower-bearing part about 1 cm. in diameter; peduncles slender, 1 cm. long; pedicels slender, short, 3–4 mm. long; flowers olivaceous-green, greenish purple, or (fide Smith) deep dull red or crimson-maroon, about 6–8 mm. in diameter; calyx unequally lobed, glabrous, the lobes 5, lanceolate or oblong, 0.5–2 mm. long, 0.5–1 mm. wide, obtuse to acute, sometimes slightly crenulate, the margins eciliate; petals 5, equal, thin, elliptic or ovate, 3–4 mm. long, 1.5–2.5 mm. wide, 5-nerved, obtuse or rounded, the margin eciliate; stamens 5, unequal; filaments short, somewhat flat, widened below and minutely gibbous at the tips, 5–10 mm. long, glabrous; anthers minute, oblong, 0.5 mm. long, extrorse; disc cup-shaped, irregularly deeply lobed, the lobes somewhat fleshy, each conspicuously tipped by a small disciform indurated gland; ovary conical, glabrous; style short, 0.5 mm. long, glabrous; stigma minute, somewhat rounded; carpidia inequilaterally obovate, about 7 mm. long, glabrous, with obscure scrobiculations, with or without persistent petals at the base.

China: Yunnan, Tengyueh, *G. Forrest 9569,* iso-syntype (A), *9717,* iso-syntype (A, photo. N), alt. 1800–2100 m., Feb. and March, 1913; Shweli-Salwin divide, *G. Forrest 21091*

(A, photo. N), March, 1922, alt. 2100–2400 m.; Shun-Ning Hsien, *C. W. Wang 71939* (A), Feb., 1936, alt. 2700 m.; Chan-Kang Hsien, *C. W. Wang 72476, 72531* (A), March, 1936, alt. 2000–2400 m.; Lung-ling Hsien, *H. T. Tsai 55528* (A), March 21, 1934, alt. 1700 m.; without locality, *G. Forrest 8469* (A).

DISTRIBUTION: China (Yunnan).

This species is recognizable by its distinctly unequal, lanceolate or oblong, acute or obtuse calyx-lobes, which are 1–2.5 mm. long, and 0.5–1 mm. wide, its somewhat crowded flowers, its short filaments, and by its distinct disc-lobes being tipped by a small indurated gland.

Fig. 3. *Sabia dumicola* W. W. Smith; *a*, a flowering branch, × 1; *b*, calyx, *c*, petal, *d*, stamens, *e*, ovary, style and disc, all × 5.

28. **Sabia heterosepala** sp. nov.

Frutex sempervirens, scandens, ramis olivaceo-brunneis vel purpureo-brunneis, teretibus, lenticellatis, glabris; ramulis pallide flavido-viridibus, teretibus, striatis, glabris; perulis glabris, late ovatis, margine eciliatis; foliis membranaceis, olivaceis, ellipticis vel oblongo-ellipticis, 6–9 cm. longis, 2.5–4 cm. latis, acutis vel acuminatis, plerumque breviter apiculatis, basi late acutis vel subrotundatis, utrinque glabris vel junioribus parcissime pubescentibus, margine anguste scarioso-subcartilagineis, eciliatis; nervis 4 vel 5 utrinque, curvato-adscendentibus, arcuato-anastomosantibus, gracilibus, subtus leviter elevatis, venulis laxe reticulatis distinctis, supra obscuris; petiolo 5–10 mm. longo, glabro; inflorescentiis axillaribus solitariis, circiter 2 cm. longis, glabris, 2-floris; pedunculis circiter 1.2 cm. longis; pedicellis 5 mm. longis, bracteolis caducis; floribus albido-viridibus, 8–10 mm. diametro; calycibus glabris, lobis 5, inaequalibus, 3 majoribus, 2 paullo minoribus, membranaceis, oblongis, 1.5–3 mm. longis, 0.5–1.5 mm. latis, rotundatis, circiter 4- vel 5-nerviis, margine eciliatis; petalis 5, aequalibus, membranaceis, obovatis, late rotundatis, 5–5.5 mm. longis, 3–3.5 mm. latis, 7-nerviis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis, 3–4 mm. longis, glabris; antheris ovoideis, 1 mm. longis; disco subcyathiformi inaequaliter breviterque lobato, lobis parvis, obtusis, glandulis induratis nullis; ovario ovoideo, glabro; stylis glabris, 4.5 mm. longis, crassis; stigmatibus minutis, rotundatis; carpidiis ignotis.

China: Hunan, Yun-schan near Wukang, *Handel-Mazzetti 87* (col. *Wang Te-Hui*), type (A), April, 1919, alt. between 400 and 1420 m.

Distribution: China (Hunan).

In its unusually large, thin, very unequal sepals this suggests *Sabia emarginata* Lecomte, as the cited specimen was originally named by Handel-Mazzetti. I am convinced that it is not the same as Lecomte's species, as a representative of the section *Odontodiscus* is indicated. None of the sepals are emarginate.

29. **Sabia fasciculata** Lecomte in herb. sp. nov. **Fig. 4.**

Sabia fasciculata Lecomte (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 77. 1936, in clavis Japonice, *nomen nudum;* Merr. Brittonia **4**: 111. 1941, *nomen nudum.*

Frutex sempervirens, scandens, ramis ramulisque plerumque brunneis vel atro-brunneis, teretibus, gracilibus, striatis, glabris; perulis glabris, late ovatis, margine eciliatis; foliis oblongis, oblongo-ellipticis vel late oblongo-lanceolatis, 6–11 (rariter ad 13) cm. longis, 1.5–3.5 cm. latis, distincte et plerumque acute acuminatis, basi acutis vel subrotundatis, coriaceis, utrinque glabris, supra pallide viridibus vel olivaceis, opacis vel subnitidis, subtus paullo pallidioribus, margine cartilagineis, eciliatis, anguste revolutis; nervis 6–8 utrinque, subpatulis, arcuato-anastomosantibus, supra obscuris, subtus elevatis, distinctis, venulis manifestis; petiolo 1–1.3 cm. longo, glabro vel aliquando sparse pubescente; inflorescentiis axillaribus, solitariis e basi ramosis, junioribus (sub alabastro) glomerulo simulantibus, sub anthesi apertis, 2–4 cm. longis, e basi ramosis, 10–20-floris; ramis primariis 4–10 mm. longis, plus minusve racemosim dispositis singulis umbellato-cymosis 3- vel 4-floris; pedicellis gracilibus, 3–6 mm. longis; floribus viridibus, 8 mm. diametro; calycibus glabris, glandulis rubris obscurissimis minutissimis praeditis, lobis 5, aequalibus, ovatis vel oblongo-ovatis, 1–2 mm. longis, acutis vel late obtusis, margine ciliatis; petalis 5, aequalibus, oblongo-ovatis vel late oblongo-lanceolatis, circiter 5 mm. longis et 2 mm. latis, 7-nerviis; sursum leviter angustatis, obtusis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis, 2.5–4 mm. longis, glabris; antheris oblongis, circiter 1 mm. longis, extrorsis; disco cyathiformi, lobulato, glandulis induratis nullis, lobis 5, obtusis; ovario conico, glabro; stylis 2.5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis rubris, obovatis, circiter 8 mm. longis, glabris, scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, southeast of Mengtze, *A. Henry 10487,* type (A, N, photo. N), alt. 1500 m., in mountain forests, flowers green; Ping-pien Hsien, *H. T. Tsai 55103* (A), alt. 1400 m., May 16, 1934, alt. 1400 m., in ravine, climbing shrub, fruit red, *H. T. Tsai 60613, 60821* (A), alt. 1300–1400 m., July 2, 1934; Wen-shan Hsien, *H. T. Tsai 51629, 51660, 51695, 51755* (A), Jan.–Feb., 1933, alt. 1800–1900 m.; Ma-kwan Hsien, *H. T. Tsai 51904* (A), March 2, 1933, alt. 1700 m.; without locality, *H. T. Tsai 57017, G. Forrest 17799* (A, photo. N); Kwangsi, Chu Feng Shan, Luchen, *R. C. Ching 5792* (N), June 7, 1928, alt. 520 m.; Yao-shan, *C. Wang 39425, 40326* (A), June 18 and Oct. 29, 1936; Ling Wan District, *S. K. Lau 28443* (A), June 19, 1937; Kwangtung, Lok Chong, *C. L. Tso 21068* (N), June 11, 1929. Indo-China: Tonkin, Chapa, *A. Pételot 4531* (N, U), Feb., 1932, alt. 1400–1500 m. Upper Burma: Mountain nullas, south of Htawgaw, *F. K. Ward 376* (A), March 9, 1939, alt. 1500 m.

Distribution: China (Yunnan, Kwangsi, Kwangtung), Indo-China, Upper Burma.

The basis of the specific name is a specimen in the Kew Herbarium (photo. N) bearing the binomial "*Sabia fasciculata* Lecomte." The axillary cymes, when very young, are actually glomerate-fasciculate, but they elongate and at full anthesis are open and up to 3.5–4 cm. long, there being no peduncle, or at most a very short one, the inflorescences being solitary, branched from the base, and with a few racemosely arranged branches along the short rachis. As the name "fasciculata" is a rather inappropriate one, because the flowers are in no sense fascicled, I should have ignored it but for the fact that it was originally used in

the anonymous Japanese key above cited. In selecting the name, Lecomte was misled by the young inflorescences on specimens of *Henry 10487* that, in bud, appear as rather dense glomerules. This type of inflorescence, i.e., one branched from the base, the few branches more or less racemosely arranged, forming what may be termed a racemose-cymose inflorescence, is distinctly unusual in *Sabia*.

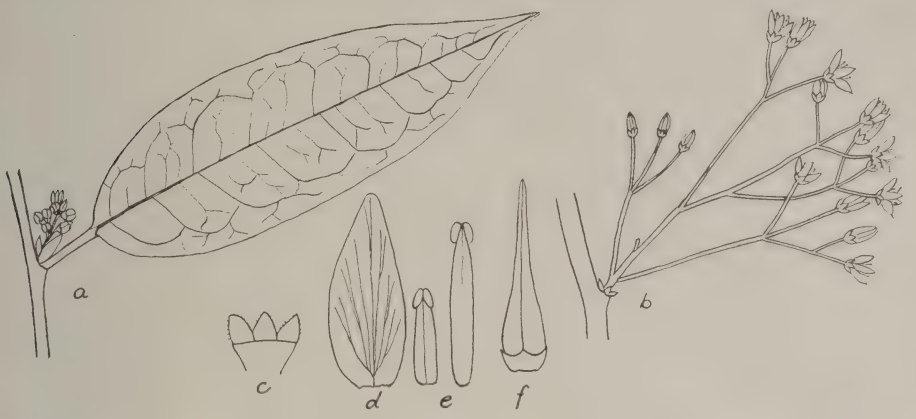

Fig. 4. *Sabia fasciculata* Lecomte; *a*, a branch with one leaf and a juvenile inflorescence, × 1; *b*, a mature inflorescence, × 1; *c*, calyx, *d*, petal, *e*, stamens, *f*, ovary, style and disc, all × 5.

30. **Sabia gracilis** Hemsl. in Hook. Ic. **29**: *t. 2831.* 1907; Fedde, Repert. Sp. Nov. **5**: 339. 1908; Rehd. & Wils. in Sargent, Pl. Wils. **2**: 198. 1914; Rehd. Jour. Arn. Arb. **15**: 9. 1934.

An evergreen, small, much-branched, suberect shrub, the branches and branchlets olivaceous or brown, slender, terete, silvery-gray- or blackish-tomentose; bud-scales sparsely pubescent or glabrous, ovate, the margins eciliate; leaves lanceolate or oblong-lanceolate, 2–7 cm. long, 1–1.5 cm. wide, rarely somewhat wider, shortly acuminate or acute, apiculate, cuneate to broadly acute at base, subcoriaceous, pale green, glabrous on the upper surface except for the conspicuously pubescent midrib paler and sparsely villose beneath, becoming glabrate with age, the margins narrowly cartilagineous, slightly undulate, eciliate; nerves 4–6 pairs, slender, arched-anastomosing, obscure above, slightly elevated beneath, the veinlets obscure above and not very prominent beneath; petioles 3–4 mm. long, slender, densely pubescent; inflorescences shortly cymose, 1–1.5 cm. long, silvery-grayish-pubescent, 2–4-flowered; peduncles slender, 4–6 mm. long; pedicels 1–2 mm. long; bracteoles pubescent, linear, 0.5–1 mm. long; flowers white or greenish white, 6–8 mm. in diameter; calyx equally 5-lobed, pubescent, becoming glabrate, the lobes ovate-lanceolate, 1 mm. long, acute, the margins ciliate; petals 5, equal, thin, lanceolate or oblong-lanceolate, 3–4 mm. long, 0.5–1 mm. wide, 5-nerved, the tips obtuse or subacute, sometimes incurved; stamens 5, equal; filaments somewhat clavate, about 1 mm. long, glabrous; anthers ovoid, 0.2 mm. long, introrse; disc somewhat cup-shaped, irregularly and shallowly lobed, the lobes 5, obtuse, without indurated glands; ovary conical or ovoid, glabrous; styles 0.5 mm. long, glabrous; stigmas minute, rounded; carpidia blue, suborbicular or subreniform, 6–7 mm. in diameter, glabrous, slightly scrobiculate, without persistent petals at the base.

China: Szechuan, Mount Omei, *E. H. Wilson 4806* (Veitch Exped.), isotype (A, photo. of type N), July, 1904, *T. T. Yü 253* (A), Apr. 14, 1932, alt. 700 m., *W. P. Fang 7593* (A), July 15, 1930; Kuan Hsien, *E. H. Wilson 2532* (A, U), July 17, 1908, alt. 900

m.; O-pien Hsien, *T. T. Yü 837* (A), May 23, 1932, alt. 1150 m.; Kikiang Hsien, *W. P. Fang 1327* (A), June 11, 1928, alt. 1050–1350 m.; Kweichow, Tungtze, *Y. Tsiang 5072* (A, U), May 26, 1930, alt. 450 m.; Keying-ten-shan, *Y. Tsiang 5306* (N), June 5, 1930, alt. 400 m.; Pachai, *Y. Tsiang 6155* (C, N), July 30, 1930, alt. 500 m.

DISTRIBUTION: China (Szechuan, Kweichow).

The general habit and appearance of this species suggests the widely distributed *Sabia Swinhoei* Hemsley, the two being clearly allied. It may be distinguished by its often incurved petals and its usually smaller, lanceolate or oblong-lanceolate leaves which are more or less silvery-grayish-pubescent beneath. The description of the carpidia is added from *Tsiang 6155*.

31. **Sabia Swinhoei** Hemsl. Jour. Linn. Soc. Bot. **23**: 144. 1886; Diels, Bot. Jahrb. **29**: 451. 1900; Hayata, Icon. Pl. Form. **1**: 160. 1911; Sasaki, List Pl. Formosa 278. 1928; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 704. 1931; Hand.-Maz. Symb. Sin. **7**: 643. 1933; Murakoshi, Nai-gwai Shokubutsu Gensho-hoku Dai Dzukan (Iconogr. Encyclop. Bot.) **5**: 47. no. 3188. 1935; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 459. 1936.

Sabia Dunnii H. Lév. Repert. Sp. Nov. **9**: 457. 1911, syn. nov.

An evergreen climbing shrub, the branches terete, flexuous, striate, pubescent, mostly pale brownish; branchlets slender, terete, flexuous, pubescent; bud-scales glabrous, ovate, the margins sparsely ciliate; leaves oblong to oblong-elliptic or ovate-elliptic, 3–12 cm. long, 2–4 cm. wide, distinctly acuminate, acute or apiculate at apex, rarely blunt, acute to obtuse but scarcely rounded at base, chartaceous to thinly coriaceous, dark to pale brown, pubescent on the midrib, rarely pubescent on the lateral nerves on the upper surface, paler beneath and rather softly pubescent especially on the midrib and nerves, the margins cartilagineous and narrowly revolute, slightly wavy and eciliate; nerves 4–6 pairs, slender, rather spreading, arched-anastomosing, rather obscure above, strongly elevated beneath, the veinlets distinct and loosely reticulate on the lower surface, obscure above; petioles 3–5 mm. long, pubescent; inflorescences cymose, 1.5–2.5 cm. long, sparsely pubescent, 2–5-flowered; peduncles filiform, 1–1.5 cm. long; pedicels filiform but somewhat thickened upward, 2–4 mm. long; bracteoles pubescent, linear, 1–2 mm. long; flowers white, 8–10 mm. in diameter; calyx equally 5-lobed, slightly pubescent and with very obscure minute reddish glands, the lobes ovate, 1 mm. long, acute, the margins ciliate; petals 5, equal, thin, ovate-lanceolate to lanceolate, 3.5–4.5 mm. long, 1 mm. wide, strongly narrowed upward, acute or somewhat blunt, 3–5-nerved, the margins eciliate; stamens 5, equal; filaments somewhat broad, 1 mm. long, glabrous; anthers minute, subrotund, 0.5 mm. long; disc cup-shaped, shallowly lobed, the lobes 5, without indurated glands; ovary conical or ovoid, glabrous; style slender, 1 mm. long, glabrous; stigma minute, capitate; carpidia dark blue or blue-black when mature, subreniform, suborbicular, or obovate, about 8 mm. long, glabrous, distinctly scrobiculate, without persistent petals at the base.

FORMOSA: Without locality, *Swinhoe*, TYPE (photo. A, N). CHINA: Kiangsu, near Nanking, *H. Q. Fu 79* (P), in 1919; Chekiang, Chang-hua, *F. N. Meyer 1539* (A), July 10, 1915, alt. 240 m.; without locality, *S. Chen 970* (A), Apr. 10, 1933; Fukien, Kuling, *H. H. Chung 6653* (A), July, 1926, *J. B. S. Norton 1477* (P, U), July 31, 1919; Inghok Hsien, *H. H. Chung 3191* (C), Apr. 23, 1925; without locality, *Dunn, Herb. Hongk. 2533* (A); Kwangtung, Taai Yeung Shan, *McClure, CCC 6480* (N), July 20, 1921, alt. 700 m.; Naam Kwan-shan, *W. T. Tsang 20203* (A, N), *20312* (N), Apr. 11–23, 1932; Jen-hua District, Man Chi Shan, *W. T. Tsang 26232* (A), Apr. 21, 1936; Loh Fau Shan, *E. D. Merrill 10745* (P), Aug. 22, 1917, alt. 1000 m., *Levine & McClure, CCC 7006* (P), Sept. 4, 1921, alt. 800 m.; Kwangsi, Pai-shou District, *Y. W. Taam 54* (A), Aug. 20, 1937; Shap-Nan Taai Shan, *W. T. Tsang 22698* (A), July 12, 1933; Kweichow, Pin-fa, *J. Cavalerie 21 bis*, isotype of *Sabia Dunnii* H. Lév. (fragment A), Apr. 4, 1902; Kiangsi, Tunghua-shan, *Y. Tsiang 10082* (N), June 30, 1932, alt. 700 m.; Ping-hsing, *Handel-*

Mazzetti (*Wang Te Hui*) *130* (A), alt. 600 m.; without locality, *K. K. Tsoong 3434* (P); Hunan, Ping Tou Shan, Pai Mu Village, *W. T. Tsang 23416* (A, U), March 21, 1934; Hupeh, Near Ichang, *A. Henry 3460* (A, G), *3460A, 4181* (G, U).

DISTRIBUTION: Formosa, China (Kiangsu, Chekiang, Fukien, Kwangtung, Kwangsi, Kweichow, Kiangsi, Hunan, Hupeh).

This species may be distinguished by its leaves being more or less pubescent beneath, usually acute at the base, and by its ovate-lanceolate petals which are strongly narrowed upward. Naturally, a wide-ranging species, such as this is according to my interpretation, shows considerable variation in the shape and size of its leaves; *Norton 1477* from Fukien has small leaves; *Tsang 20203* from Kwangtung has longer leaves up to 12 cm. in length. The larger leaves on the original Formosan type are only about 5 cm. long. Two extreme forms, one from Hainan and one from Hupeh, Chekiang, and Kwangsi, are below designated as varieties, admittedly on not very strong characters.

Sabia Dunnii H. Lév. was reduced to *Sabia gracilis* Hemsl. by Rehder, Jour. Arnold Arb. **15**: 9. 1934, but it seems to me to be more closely related to *Sabia Swinhoei* Hemsl. on account of the shape and color of its slightly pubescent leaves, the type of pubescence, and the details of its floral parts.

31a. **Sabia Swinhoei** Hemsl. var. **subcorymbosa** (Stapf) stat. nov.

Sabia subcorymbosa Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 77. 1936, in clavis Japonice, *nomen nudum.*

A typo differt foliis basi rotundatis, haud acutis.

CHINA: Hupeh, Nanto, *Wilson 184* (Veitch Exped.), TYPE (K, photo. N, frustulum A), scandent, flowers yellow; Chekiang, south of Ping Yung, *R. C. Ching 2006* (A, C, L, N, U), scandent, alt. 60 m., July 5, 1924; Kwangsi, Yung Hsien, *A. N. Steward & H. C. Cheo 889* (A), Aug. 29, 1933, alt. 540 m.

DISTRIBUTION: China (Hupeh, Chekiang, Kwangsi).

Handel-Mazzetti, Symb. Sin. **7**: 643. 1933, placed *Sabia subcorymbosa* Stapf as a synonym of *Sabia Swinhoei* Hemsl. This form is manifestly very close to Hemsley's species, and like that has somewhat pubescent inflorescences and sepals. The chief difference appears to be in the shape of the leaves, which are distinctly rounded at the base, not acute. The leaves are mostly oblong-ovate and vary from 4 to 10 cm. long and 2.5 to 5 cm. wide. In characters other than the leaf-shape this variety conforms closely to *Sabia Swinhoei* Hemsl.

31b. **Sabia Swinhoei** Hemsl. var. **hainanensis** var. nov.

A typo differt foliis plerumque ovatis, basi latissime rotundatis, inflorescentiis calycibusque glabris.

CHINA: Hainan, Bak Sa, *S. K. Lau 25751,* TYPE (A), March 18, 1936, a scandent shrub in forests, flower white.

DISTRIBUTION: China (Hainan).

The leaves are very different in shape from those of the Formosan type, which are oblong and subequally narrowed to the acute or slightly acuminate tips and the acute bases. In the new variety they are 4–9 cm. long and 2–5.5 cm. wide and always very broadly rounded at the base.

32. **Sabia discolor** Dunn, Jour. Linn. Soc. Bot. **38**: 358. 1908; Merr. & Chun, Sunyatsenia **1**: 68. 1930.

An evergreen scandent shrub, the branches and branchlets grayish glaucous to dark brown, terete, slightly flexuous, striate, glabrous; bud-scales glabrous, ovate, the margins eciliate; leaves ovate to ovate-elliptic or elliptic, 4–7 cm. long, 2–3.8 cm. wide, subacute to obtuse, rounded or obtuse at base, chartaceous to subcoriaceous (or when young submembranaceous), glabrous on both surfaces,

greenish olivaceous to very dark brown or almost black on the upper surface when dry, beneath pale, glaucous, in strong contrast to the upper surface, the margins subcartilagineous, eciliate, slightly revolute; nerves 3 or 4 pairs, slender, curved-ascending, arched and joined by means of the secondary veins, elevated, the veinlets prominently and loosely reticulate on the lower surface, obscure above; petioles 0.7–1.5 cm. long, slender, glabrous; inflorescences axillary, solitary, umbellately cymose, 2–4-flowered, 2–3 cm. long, glabrous; peduncles slender, subglaucous, 1–3 cm. long; pedicels subglaucous, 4–7 mm. long; bracteoles caducous; flowers green to yellowish green, small, about 4 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes ovate or triangular, 1 mm. long, acute or obtuse, the margins ciliate; petals 5, equal, thin, ovate to elliptic-ovate, 2–3 mm. long, 1.5 mm. wide, 5–7-nerved, obtuse; stamens 5, subequal; filaments 1.8–2 mm. long, glabrous; anthers oblong, 1 mm. long, extrorse; disc cup-shaped, irregularly shallowly lobed, the indurated glands none; ovary ovoid, glabrous; styles 3–4 mm. long, glabrous; stigmas minute, capitate; carpidia suborbicular-obovate or obovate, more or less inequilateral, pink or red, becoming blue at full maturity, 5 mm. in diameter, subglaucous, glabrous, scrobiculate, without persistent petals at the base.

China: Chekiang, Sze-tou, south of Siachi, *R. C. Ching 1722* (A, C, L, U), June 1, 1924, alt. 550 m.; Fukien, Yangping, *Dunn, Hongk. Herb. 2536,* iso-syntype (A, N), *2537,* iso-syntype (A), Apr.–June, 1905, alt. 700 m., *H. H. Chung 3276* (A, C), June 10, 1925, alt. 800 m.; Kwangtung, Tsin Leong San, *J. L. Gressitt 1249* (A), June 3, 1936, alt. 850 m.; Ting Leng Shan, *McClure, CCC 6754* (P), July 30, 1921, alt. 600 m.; Lok Chong, *C. L. Tso 20434* (N), May 11, 1929, Yaoshan, *S. S. Sin 9799* (N), Apr. 26, 1930; Wan Tong Shan, *T. M. Tsui 388* (A, N, P, U), June 6–24, 1932; Sam Kok Shan, *W. T. Tsang 20633* (A, N), May 30, 1932, *25026, 25159* (A), April–May, 1935; Tai Mo Shan, *W. T. Tsang 21223* (A, B, N, P), July 18, 1932; Kwai Shan, *W. T. Tsang 28579* (A), March 16–31, 1938; Kiangsi, Chung Yih, *H. H. Hu 946* (A, P), Apr. 20, 1921, alt. 750 m.

Distribution: China (Chekiang, Fukien, Kwangtung, Kiangsi).

This species is readily distinguished by its vegetative characters, the pale glaucous lower leaf-surface in sharp contrast to the dark colored upper surface. The leaves of *Chung 3276* and *Hu 946* are slightly less glaucous than the other specimens and are more shiny on the upper surface, but otherwise they cannot be separated from the typical form of the species. It was erroneously recorded from Yunnan by H. H. Chung, Mem. Sci. Soc. China 1: 152. 1924, the basis of this record being *Henry 10496* and *10529,* which represent *Sabia pallida* Stapf.

33. **Sabia coriacea** Rehd. & Wils. in Sargent, Pl. Wils. 2: 198. 1914; Chun, Sunyatsenia 1: 266. 1934. **Fig. 5.**

An evergreen scandent shrub, about 5 m. high, the branches and branchlets dark brown, terete, slender, glabrous; bud-scales glabrous, ovate, the margins sparsely ciliate or eciliate; leaves oblong to oblong-lanceolate, 3.5–6.5 cm. long, 1.5–2.5 cm. wide, rarely up to 3 cm. wide, acute or acuminate, broadly cuneate or subrotund at base, coriaceous, glabrous on both surfaces, chestnut-brown to olivaceous on the upper surface and usually strongly shining, pale olivaceous-green beneath, the margins cartilaginous, eciliate, narrowly revolute when dry; nerves 4 or 5 pairs, usually curved-ascending, arcuate-anastomosing, mostly strongly elevated beneath, the veinlets loosely reticulate on both surfaces, more obscure above; petioles 1 cm. long, glabrous; inflorescences cymose or subumbellate, axillary, solitary, about 2.5 cm. long, glabrous, 3–10-flowered; peduncles slender, 1–1.5 cm. long; pedicels subfiliform, 0.3–0.5 mm. long; bracteoles glabrous, linear, 1 mm. long; flowers apparently greenish, 4–6 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes broadly ovate, 1 mm. long, shortly acute or obtuse, the margins minutely ciliate; petals 5, equal, fairly thin, oblong-ovate or ovate-lanceolate, 2–3 mm. long, 1–1.5 mm. wide, 5-nerved

(nerves prominent), shortly acute or obtuse, inflexed, the margins eciliate; stamens 5, unequal; filaments complanate, 1–1.5 mm. long, glabrous; anthers minute, ovoid or oblong, 0.5 mm. long, introrse; disc somewhat cup-shaped, irregularly shallowly lobed, the lobes 5, each obscurely tipped by a very minute indurated disciform gland; ovary ovoid, glabrous; styles 0.5 mm. long, glabrous; stigmas minute, rounded; carpidia suborbicular-obovate, when nearly mature about 5 mm. in diameter, glabrous, obscurely scrobiculate, when fresh red or reddish purple, without persistent petals at the base.

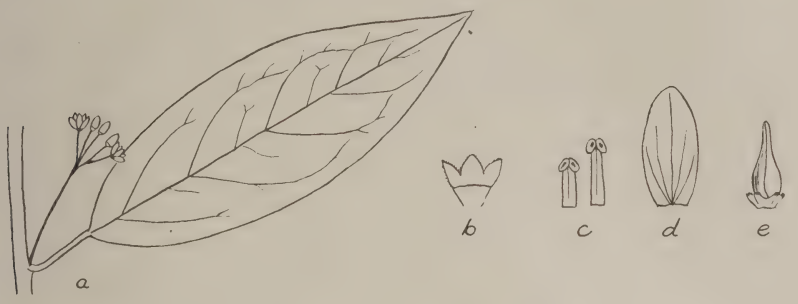

Fig. 5. *Sabia coriacea* Rehd. & Wils.; *a*, a branch with leaf and inflorescence, × 1; *b*, calyx, *c*, stamens, *d*, petal, *e*, ovary, style and disc, all × 5.

China: Fukien, Liu Kai Kan, *Dunn, Herb. Hongk. 2534*, type (A, photo. N), April–July, 1905, alt. 300 m.; Gang Keu, *J. L. Gressitt 1718* (A), July 25, 1936, alt. 635 m.; Kwangtung, Yam Na Shan, *W. T. Tsang 21362* (A, B, N, P), Aug. 4–31, 1932, fruit reddish purple; Lin Fa Shan, *W. T. Tsang 25510* (A), Aug. 11–31, 1935, fruit red; Fan Shui Shan, *S. K. Lau 2718* (A), Nov. 1–12, 1933, fruit pink, scandent, to 2–4.5 m., in thickets and in ravines.

Distribution: China (Fukien, Kwangtung).

This species is characterized by its often shining, coriaceous, glabrous, loosely reticulate leaves and its cup-shaped, irregularly and shallowly lobed disc, each disc-lobe obscurely tipped by a very minute indurated disciform gland.

34. **Sabia purpurea** Hook. f. & Th. Fl. Ind. **1**: 209. 1855; Walp. Ann. Bot. Syst. **4**: 138. 1857; Hook. f. Fl. Brit. Ind. **2**: 2. 1879; Osmaston, For. Fl. Kumaon 132. 1927; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 324. 1937.

Sabia parviflora Wall. List 1001. 1829, *nomen nudum* (pro parte).

A deciduous scandent shrub, the branches and branchlets pale brownish green to subolivaceous, terete, striate, glabrous; bud-scales glabrous, broadly ovate, the margins eciliate; leaves oblong to broadly oblong-lanceolate, 5–8 cm. long, 2–2.5 cm. wide, long-acuminate, broadly acute to rounded at base, firmly chartaceous, membranaceous when young, glabrous on both surfaces, olivaceous above, paler beneath, the margins narrowly cartilagineous; nerves 3 or 4 pairs, slender, curved, arched-anastomosing, not prominent above, elevated beneath, the reticulations rather prominent on the lower surface, somewhat obscure above; petioles 3–10 mm. long, slender; inflorescences shortly cymose, glabrous, about 1.5–2 cm. long, 3–5-flowered; peduncles 5 mm. long; pedicels 5–10 mm. long, slightly thickened upwards; bracteoles glabrous, linear, 1 mm. long; flowers 6–7 mm. in diameter, purplish or claret-colored; calyx equally 5-lobed, glabrous and with a few minute obscure reddish glandular dots, the lobes ovate, 0.5 mm. long, subacute, the margins subciliate; petals 5, equal, thin, ovate or triangular-ovate, narrowed upward from the very broad base, 3–3.5 mm. long, 1.5–2 mm. wide, acute or subobtuse, 5-nerved, the nerves nearly parallel, the margin eciliate; stamens 5, equal; filaments rather broad, linear, 1 mm. long, glabrous; anthers

oblong, 0.5 mm. long, extrorse; disc cup-shaped, irregularly deeply lobed, the lobes 5, somewhat fleshy, obtuse, without indurated glands; ovary ovoid, glabrous; styles 0.5 mm. long, glabrous; stigmas minute, rounded; carpidia suborbicular to obovate, 3–5 mm. in diameter, glabrous, distinctly scrobiculate, without persistent petals at the base.

India: Assam, "Khasia," *Hooker f. & Thomson s.n.*, isotype (G), alt. 1200–1800 m.; Khasi and Jaintia Hills, Shillong, *L. F. Ruse 5* (A), flowers claret-colored, March 3, 1923, alt. 1500 m.; Nepal, *Wall. List no. 1001 in part* (N).

Distribution: India.[1]

35. **Sabia falcata** sp. nov.

Frutex sempervirens, scandens, 3 m. altus, ramis ramulisque pallide olivaceo-viridibus, vel ramulis pallide brunneis, teretibus, striatis, glabris; perulis glabris, ovatis, breviter acuminatis, margine sparse ciliatis; foliis oblongo-lanceolatis vel anguste oblongo-ovatis, 7–12 cm. longis, 2–4 cm. latis, longe subcaudato-acuminatis (acuminibus plus minusve falcatis, apiculatis), basi late acutis vel obtusis, membranaceis, utrinque glabris, supra olivaceo-viridibus, subtus pallidioribus, margine angustissime subscarioso-cartilagineis, leviter undulatis, eciliatis, nervis 4 vel 5 utrinque, gracilibus, curvatis, arcuato-anastomosantibus, subtus elevatis, distinctis, venulis laxe reticulatis, supra obscuris, subtus manifestis; petiolo 7–8 mm. longo, glabro; inflorescentiis cymosis, circiter 2 cm. longis, glabris, 2–4-floris; pedunculis circiter 1 cm. longis, gracilibus; pedicellis 5 mm. longis; bracteolis glabris, linearibus, circiter 1 mm. longis, margine eciliatis; floribus 8 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, 1 mm. longis, breviter acutis vel obtusis, margine eciliatis; petalis 5, aequalibus, submembranaceis, oblongo-lanceolatis, 3.5–4 mm. longis, 1–3 mm. latis, circiter 5-nerviis, breviter acutis, margine eciliatis; staminibus 5, subaequalibus; filamentis complanatis, 0.5–0.8 mm. longis, glabris; antheris oblongis, 0.5 mm. longis, introrsis; disco cyathiformi, ecostato, irregulariter lobato, lobis 5, obtusis, glandulis parvis induratis disciformibus terminantibus; ovario ovoideo, glabro; stylis circiter 0.8 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis suborbicularibus vel subreniformibus, 4–5 mm. diametro, glabris, subdistincte scrobiculatis, petalis ad basim subpersistentibus.

Burma: Haka, *F. G. Dickason 7480*, type (A), April 18, 1938, alt. 2188 m., a scandent shrub about 3 m. high.

Distribution: Burma.

This species is allied to *Sabia parvifolia* Chen, but, as noted under that species, it has very much larger leaves.

36. **Sabia malabarica** Bedd. Ic. Pl. Ind. Orient. 39. *t. 177.* 1874; Hook. f. Fl. Brit. Ind. 2: 2. 1876; Gamble, Fl. Presid. Madras 1: 254. 1918.

"A glabrous climber, leaves from oblong to lanceolate with a gradual acumination ending in a mucro-coriaceous with the margin thickened, 3–4½ inches long by 1–2 broad, primary veins looped well within the margin and the reticulated veinlets very prominent on the under side, petioles ½ to 1 inch long, racemes axillary few flowered, or in axillary leaf-bearing panicles, flowers very small hermathrodite pentamerous, calyx minutely hairy, styles 2, petals oval, stamens shorter than the petals, filaments flat, ovules superposed, drupes flat reniform scrobiculate.

Anamallay forests, 3000–4000 feet elevation." [ex Beddome].

[1] Diels, Bot. Jahrb. **29**: 451. 1901, and Léveillé, Fl. Kouy-Tchéou 375. 1915, credited this species to China, but I have seen no Chinese specimens that I can refer to it, and I suspect that both records were based on erroneous identifications. This species seems to be limited to Assam and Nepal.

"Leaves elliptic-oblong acuminate margins waved base rounded, cymes very short 2–6-flowered, petals elliptic obtuse, filaments subulate.

Western Peninsula; Anamallay hills, alt. 3–4000 ft., *Beddome*.

A climbing shrub, quite glabrous. *Leaves* 3–5 by 1–1¾ in., thinly coriaceous, pale, margin cartilaginous; nerves many, spreading, much reticulated beneath; petiole ½–1 in. *Peduncle* ¼–½ in. *Flowers* $\frac{1}{10}$ in. diam. *Sepals* small, ovate, acute, ciliate. *Petals* glabrous. *Stamens* shorter than the petals. *Filaments* slender. *Anthers* didymous, cells diverging. *Ovules* subcollateral. *Drupe* ½ in., reniform, reticulated." [ex Hooker f.]. Disc more or less cup-shaped, irregularly deeply lobed, the lobes ovate, acute, without indurated glands. The one petal I have seen is but 2 mm. long.

Southern India: Madras, Anamallay Hills, *Beddome* (K), alt. 900–1200 m.

Distribution: Southern India.

I have seen no specimens representing this species, and the quoted descriptions seem to be all that have so far been published regarding it. The species is known only from the type collection. The description of the disc and the note concerning the length of the petals was added from a single flower from the type collection, courteously sent by Dr. A. D. Cotton of the Royal Botanic Gardens, Kew.

37. **Sabia parvifolia** sp. nov.

Frutex sempervirens, scandens, ramis ramulisque plerumque pallide brunneis, teretibus, striatis, glabris; perulis glabris, ovatis, margine eciliatis; foliis oblongis vel ovato-lanceolatis, 3–5 cm. longis, 1–1.8 cm. latis, distincte caudato-acuminatis (acuminibus apiculatis), basi subrotundatis, chartaceis, utrinque glabris, supra viridibus vel olivaceis, subtus paullo pallidioribus, margine angustissime cartilagineis, eciliatis, obscure revolutis; nervis 3–5 utrinque, curvatis, arcuato-anastomosantibus, subtus leviter elevatis, conspicuis, venulis prominenter reticulatis, supra obscuris; petiolo 4–7 mm. longo, glabro, margine ciliato; inflorescentiis cymosis, circiter 2 cm. longis, glabris, 3–5-floris; pedunculis 5–12 mm. longis; pedicellis brevibus, gracilibus, circiter 5 mm. longis; bracteolis glabris, lanceolatis, margine sparse ciliatis; floribus 6 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis vel triangularibus, circiter 1 mm. longis, acutis vel obtusis, margine ciliatis; petalis 5, aequalibus, membranaceis, obscure minutissime rubro-punctatis, oblongo-ovatis vel ovato-ellipticis, circiter 3 mm. longis et 1.5 mm. latis, 3–5-nerviis, obtusis vel rotundatis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis, brevibus, 0.5–0.8 mm. longis, glabris; antheris ovoideis, circiter 0.5 mm. longis; disco cyathiformi, ecostato, lobato, lobis 5, obtusis, glandulis parvis induratis disciformibus terminantibus; ovario ovoideo, glabro; stylis brevibus, circiter 0.8 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis suborbicularibus vel orbiculari-obovatis, circiter 4–5 mm. diametro, glabris, scrobiculatis, petalis ad basim persistentibus vel tarde deciduis.

China: Yunnan, Chenkang Snow Range, Pangca, *T. T. Yü 17082*, type (A), July 29, 1938, alt. 2300 m., a common shrub in thickets, the immature fruit green.

Distribution: China (Yunnan).

This species somewhat resembles *Sabia falcata* Chen but has much smaller, more distinctly reticulate leaves and broader petals which are rounded at their apices rather than acute.

38. **Sabia acuminata** sp. nov.

Frutex sempervirens, scandens, ramis ramulisque pallide viridibus vel pallide brunneis, gracilibus, teretibus, leviter flexuosis, striatis, glabris; perulis glabris, ovatis, acuminatis, margine eciliatis; foliis ovato-lanceolatis vel late oblongo-

lanceolatis, 5–8 cm. longis, 1.5–3 cm. latis, longe acuminatis, apicibus plerumque apiculatis, basi subrotundatis vel obtusis, tenuiter chartaceis vel submembranaceis, utrinque glabris, supra olivaceo-viridibus, opacis, subtus pallidioribus, nitidis, margine anguste cartilagineis, eciliatis, nervis 4 vel 5 utrinque, gracilibus, curvatis, arcuato-anastomosantibus, utrinque leviter elevatis et venulis graciliter reticulatis; petiolo 4–6 mm. longo, gracili, glabro; inflorescentiis paucis, axillaribus, solitariis, cymosis, 1–2 cm. longis, glabris, 2–4-floris; pedunculis 1–1.5 cm. longis, gracilibus; pedicellis 3–4 mm. longis, gracilibus; bracteolis glabris, anguste lanceolatis, 1 mm. longis, margine ciliatis; floribus ignotis; calycibus glabris, lobis 5, aequalibus, ovatis, breviter acutis vel late obtusis, margine eciliatis; disco cyathiformi, ecostato, irregulariter lobulato, lobis 5, obtusis, glandulis parvis induratis disciformibus terminantibus; ovario subconico vel ovoideo, glabro; stylis 0.5 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis obovatis immaturis in sicco pallidis, 4 mm. longis, 3 mm. latis, glabris, levibus vel obscurissime scrobiculatis, petalis ad basim haud persistentibus.

China: Yunnan, Shunning, Huilungsu, *T. T. Yü 16171,* type (A), June 7, 1938, alt. 2050 m., a climbing shrub in thickets.

Distribution: China (Yunnan).

A species in the general alliance with *Sabia falcata* Chen of Burma and *S. parvifolia* Chen of Yunnan, but the carpels are non-scrobiculate or at most only very obscurely so.

39. **Sabia brevipetiolata** sp. nov.

Frutex suberectus, 2 m. altus, glaber, ramis purpureo-brunneis vel brunneis, teretibus, striatis, ramulis gracilibus, pallide viridibus vel subbrunneis; perulis glabris, late ovatis, obtusis, margine eciliatis; foliis junioribus membranaceis, elliptico-ovatis, maturis subchartaceis, ovato-lanceolatis vel oblongo-ovatis, 2.5–6.5 cm. longis, 1–2.5 cm. latis, acute acuminatis, basi rotundatis vel obtusis, utrinque glabris, supra olivaceis, subtus paullo pallidioribus, margine anguste scarioso-cartilagineis, eciliatis, leviter revolutis, nervis 3–5 utrinque, gracilibus curvatis, arcuato-anastomosantibus, subtus elevatis, venulis laxe reticulatis, supra obscuris; petiolo plerumque 2–3 mm. (rariter 4–5 mm.) longo, glabro; inflorescentiis cymosis, axillaribus, solitariis, 1–1.8 cm. longis, glabris, 2–4-floris; pedunculis 5–10 mm. longis, gracilibus; pedicellis brevibus, 3–4 mm. longis, gracilibus; bracteolis glabris, linearibus, circiter 1 mm. longis; floribus parvis, viridibus, circiter 5 mm. diametro; calycibus aequaliter 5-lobatis, glabris, lobis ovatis, 0.5 mm. longis, obtusis, margine eciliatis; petalis 5, aequalibus, oblongo-ellipticis, 2.5 mm. longis, 1.2 mm. latis, obtusis, 5-nerviis, margine eciliatis; staminibus 5, aequalibus; filamentis complanatis, 1 mm. longis, glabris; antheris ovoideis, 0.2 mm. longis, extrorsis; disco cyathiformi, ecostulato, margine lobulato, lobis ovatis, acutis vel obtusis, glandulis induratis nullis; ovario ovoideo, glabro; stylis 1.2 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis viridibus, suborbicularibus, 4–5 mm. longis, 6 mm. latis, glabris, distincte scrobiculatis, petalis ad basim haud persistentibus.

China: Kwangsi, Loh Hoh Tsuen, Lin Yuin Hsien, *A. N. Steward & H. C. Cheo 171,* type (A, B, N), April 12, 1933, alt. 1150 m., shrub along roads, flowers green; same locality, *A. N. Steward & H. C. Cheo 712* (A), July 10, 1933, alt. 1150 m., fruit green; Kweichow, Chengfeng, *Y. Tsiang 4630* (A, N, U), Oct. 17, 1930, a shrub in dense woods, fruits blue.

Distribution: China (Kwangsi, Kweichow).

This is allied to *Sabia Wangii* Chen, but it can be distinguished from that species by its shorter petioles, peduncles, and pedicels, and by its persistent bracteoles, which are glabrous, linear, and about 1 mm. long. It also resembles *Sabia olacifolia* Stapf, but it has much smaller leaves and usually much shorter petioles than does Stapf's species, while its pedicels are very much shorter.

40. **Sabia Wangii** sp. nov.

Frutex sempervirens, glaber, scandens, ramis ramulisque pallide viridibus, teretibus, striatis, gracilibus, glabris; perulis glabris, ovatis, acutis, margine minutissime ciliatis; foliis submembranaceis, ovato-lanceolatis vel oblongo-ovatis, 4–7 cm. longis, 1.5–2.8 cm. latis, graciliter et acute acuminatis, acuminibus interdum leviter falcatis, basi late rotundatis vel truncato-rotundatis vel fere subcordatis, utrinque glabris, supra olivaceis, subtus paullo pallidioribus, margine anguste cartilagineis, eciliatis; nervis 4 vel 5 utrinque, gracilibus, curvatis, arcuato-anastomosantibus, subtus elevatis, venulis laxe reticulatis, supra obscuris; petiolo 3–4 mm. (rariter 5 mm.) longo, glabro; floribus (haud visis) cymosis, cymis axillaribus, solitariis, circiter 3 cm. longis, glabris, 2- vel 3-floris, pedunculis sub fructu 1.5–2 cm. longis, gracilibus; pedicellis circiter 1–1.5 cm. longis, gracilibus; bracteolis caducis; sepalis glabris, aequalibus, ovatis, 0.5 mm. longis, obtusis vel rotundatis, margine eciliatis; disco cyathiformi, ecostulato, margine lobulato, lobis 5, ovatis, acutis vel obtusis, eglandulosis; ovario ovoideo, glabro; stylis 1 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis viridibus, suborbicularibus, vel inaequilateraliter subreniformibus, circiter 5 mm. diametro, glabris, scrobiculatis, petalis ad basim haud persistentibus.

China: Kwangsi, Nam Tayuen, *C. Wang 40857*, type (A), June 22, 1937, alt. 750 m., a scandent shrub near streams, flowers white, fruit green.

Distribution: China (Kwangsi).

This somewhat resembles *Sabia olacifolia* Stapf, but it may be distinguished by its smaller leaves, which are broadly truncate-rounded at their bases, as well as by its elongated slender pedicels. There are no petals on the material available, most of the flowers being just past anthesis.

41. **Sabia Dielsii** H. Lév. Rep. Sp. Nov. **9**: 456. 1911, Fl. Kouy-Tchéou 379. 1915; Rehder, Jour. Arnold Arb. **15**: 9. 1934.

An evergreen scandent shrub, the branches and branchlets dark brown, shiny, terete, flexuous, glabrous; bud-scales glabrous, ovate or broadly ovate, the margins eciliate; leaves lanceolate, 6–12 cm. long, 2–3 cm. wide, gradually tapering upward to the long acuminate apex, broadly acute or rounded at base, chartaceous, glabrous on both surfaces, olivaceous and usually shining on the upper surface, pale green beneath, the margins very narrowly cartilagineous, slightly undulate, eciliate, slightly revolute; nerves 4 or 5 pairs, slender, ascending, arcuato-anastomosing, not conspicuous on the upper surface, prominently elevated beneath, the veinlets loosely reticulate on the lower surface, obscure above; petioles 4–7 mm. long, glabrous; inflorescences cymose, 2.5 cm. long, glabrous, 2–4-flowered; peduncles slender, 2 cm. long; pedicels slender, slightly thickened upwards, 8 mm. long; bracteoles caducous; flowers 5-merous, greenish yellow (ex Léveillé); calyx equally 5-lobed, glabrous; petals ovate, obtuse; stamens 5, short; disc cup-shaped, shallowly 5-lobed, the lobes without indurated glands; ovary ovoid or conical, glabrous; styles short, about 1 mm. long, glabrous; stigmas minute, somewhat rounded; carpidia subreniform or suborbicular, 6 mm. long, 7–8 mm. wide, glabrous, distinctly scrobiculate and with scattered but distinct slightly raised brown spots, without persistent petals at the base.

China: Kweichow, Pin-fa, *J. Cavalerie 1008* (fragment of mero-syntype and photo. of syntype A), May 14, 1903, and without locality, *J. Esquirol 474* (fragment of mero-syntype and photo. of syntype A, photo. N); Yunnan, Ping-pien Hsien, *H. T. Tsai 62774* (A), alt. 1500 m., July 18, 1934.

Distribution: China (Kweichow, Yunnan).

The Yunnan collection, *Tsai 62774*, closely matches our fragments of the Cavalerie and Esquirol collections from Kweichow. The species is characterized

by its mature carpidia being provided with scattered slightly raised almost pustular brown spots. The description of the disc has been added from *Tsai 62774*. I have seen no flowers, such data as are above included in the description being taken from Léveillé's original, very inadequate description. Rehder, Jour. Arn. Arb. **15**: 9. 1934, reduced *Sabia puberula* Rehd. & Wils. to Léveillé's species, but I consider the two to be distinct.

42. **Sabia olacifolia** Stapf, in herb. sp. nov.

Sabia olacifolia Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 78. 1936, in clavis Japonice, *nomen nudum*.

Frutex sempervirens, scandens, glaber, ramis ramulisque plerumque stramineis vel pallide flavido-viridibus, teretibus, striatis, gracilibus; perulis glabris, lanceolatis, margine eciliatis; foliis elliptico-ovatis vel ovato-lanceolatis, 6–14 cm. longis, 2.5–6 cm. latis, distincte acuminatis, basi late acutis vel rotundatis, interdum leviter decurrentibus, chartaceis vel submembranaceo-chartaceis, supra olivaceis, subtus paullo pallidioribus, margine anguste cartilagineis, leviter undulatis, eciliatis, revolutis; nervis 4–6 utrinque, curvatis, arcuato-anastomosantibus, subtus elevatis, distinctis, venulis laxe reticulatis, supra obscuris; petiolo 6–15 mm. longo, glabro; inflorescentiis cymosis, axillaribus, solitariis, 2.5–6 cm. longis, 2–6-floris; pedunculis gracilibus, 2.5–4 cm. longis; pedicellis gracilibus, 5–10 mm. longis; bracteolis linearibus, 2 mm. longis, glabris; floribus viridibus, circiter 5 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, circiter 1 mm. longis, acutis vel obtusis, margine eciliatis; petalis 5, aequalibus, membranaceis, obovatis vel ovato-ellipticis, 2–2.5 mm. longis, 1.5–2 mm. latis, rotundatis, 5-nerviis, margine eciliatis; staminibus 5, aequalibus; filamentis crassis, circiter 0.8 mm. longis, glabris; antheris ovoideis, circiter 0.5 mm. longis, extrorsis; disco cyathiformi, regulariter lobulato, lobis 5, obtusis, glandulis induratis nullis; ovario ovoideo, glabro; stylis circiter 1 mm. longis, glabris; stigmatibus minutis, rotundatis; carpidiis subreniformibus vel suborbicularibus, circiter 8 mm. diametro, glabris, perspicue scrobiculatis, primo albo-rubris, maturis atris (fide Henry), petalis ad basim haud persistentibus.

China: Yunnan, Shunning, *T. T. Yü 16821* (A), July 18, 1938, alt. 1680 m.; Kien-Shuei Hsien, *H. T. Tsai 53116* (A), Apr. 11, 1933, alt. 1900 m.; Ping-pien, *H. T. Tsai 60912, 60982, 61010* (A), July 15–19, 1934, alt. 1400–1500 m.; Mengtze, *A. Henry 10250,* TYPE (A, N, photo. N), Nov. 22, alt. 1500 m.; without locality, *H. T. Tsai 62823* (A). Indo-China: Tonkin, Chapa, *A. Pételot 1774, 3069* (A, C), *2182, 2183, 3793* (A), along roads in forests, alt. 1500–1600 m., April, July, and August, 1925, 1927, 1930, and 1936.

Distribution: China (Yunnan), Indo-China (Tonkin).

This species is characterized by being entirely glabrous, and by its long-peduncled, simple or subsimple, few-flowered cymes, its elliptic-ovate to ovate-lanceolate acuminate leaves, the shallowly lobed disc being without indurated glands. The basis of the name is a single sheet, *Henry 10250,* in the Kew Herbarium, the pencilled name *Sabia olacifolia* is in what may be Stapf's handwriting. There is a photograph of this sheet in the Britton Herbarium, New York Botanical Garden.

43. **Sabia tomentosa** Hook. f. Fl. Brit. Ind. **2**: 3. 1879.

"Branches and nerves of leaves beneath tomentose, leaves elliptic or elliptic-lanceolate acute, petiole very short, panicles branched many-flowered and glabrous, petals linear-oblong, stamens included.

Upper Assam? alt. 3500 ft., *Griffith*.

Branches slender, the younger clothed with soft spreading hairs, as are the petioles. *Leaves* 2½ by 1 in., rather coriaceous, bullate between the spreading nerves, which are very prominent and hairy beneath; petiole $\frac{1}{10}$ in. *Panicle*

much branched, many-flowered, peduncle puberulous; branches and pedicels slender, glabrous. *Flowers* $\frac{1}{12}$ in. diam. *Filaments* ligulate, shorter than the petals. *Fruit* didymous, of two obovoid diverging rugose subcompressed carpels, each nearly $\frac{1}{3}$ in. long.—The only specimen I have seen has but two leaves, and is remarkable for its very short petioles and tomentum. There is no habitat on the ticket, which resembles those of Griffith's journey from Upper Assam to Birma. It contains the following inscriptions:—'Sabia sp., fructibus subrotundis. 15. Alt. 3500.'" [ex Hooker f.] Disc cup-shaped, regularly shallowly lobed, the lobes small, each prominently tipped by a small indurated disciform gland. Petals not seen, but if Hooker's measurement of the flower diameter is correct (one-twelfth inch) they should be less than 2 mm. in length.

DISTRIBUTION: Upper Assam or Burma, alt. about 1000 m.

I have seen no specimens representing this species. The disc characters have been added to Hooker's quoted description from a flower of the Griffith collection on which Hooker's description was based, kindly sent by Dr. A. D. Cotton of the Royal Botanic Gardens, Kew, who also courteously provided a photograph of the type sheet in the Kew Herbarium.

44. **Sabia Wardii** W. W. Smith, Notes Bot. Gard. Edinb. **10**: 64. 1917.

"Species affinis *S. tomentosae,* Hook. f. a qua petiolis longioribus, pedicellis pilosulis, sepalis sparsim pilosulis divergit.

Frutex vix 2 m. altus; ramuli pilis patentibus fulvidis dense tomentosi. Folia petiolo 6–7 mm. longo fulvido-tomentoso suffulta; lamina vulgo 6–12 cm. longa, 3–5 cm. lata, elliptico-lanceolata vel elliptica, apice acutissima vel breviter acuminata, basi rotundata, subcoriacea, supra atroviridis glabra nisi ad costam impressam pilosulam, infra subcuprea glabra costa nervisque sparsim pilosis exceptis; nervi 4–5 paria fere recto angulo abeuntes longe intra marginem arcuatim confluentes. Flores flavido-virides in paniculas ramosas dispositi; pedunculi 2.5–5 cm. longi dense fulvido-pilosi; ramuli pedicellique graciles dense pilosi. Sepala 1.5–2 cm. [mm.] longa, ovato-lanceolata, acuta, extus sparsim pilosula. Petala circ. 3 mm. longa, fere 2 mm. lata, plus minusve elliptica, obtusa. Stamina circ. 2 mm. longa filamentis complanatis. Discus glaber. Ovarium glabrum vix 1 mm. diametro; stylus 1 mm. paulo superans stigmate minuto. Fructus deest.

'Northern Burma:—On granite conglomerate of Putao ridge, in thickets, partly shaded; 1200 ft. Lax shrub of about 5 ft. Flowers pale greenish-yellow. Nov. 1914.' F. K. Ward. No. 1955.

This species must be closely akin to the little known *S. tomentosa,* Hook. f. which is described as having shorter petioles, the pedicels and branchlets of inflorescence glabrous, and much smaller flowers." (TYPE E, frustulum A).

I have seen but a single leaf and inflorescence representing this species, this material from the type collection at the Royal Botanic Garden, Edinburgh, having been courteously supplied by Sir W. W. Smith. The following additional descriptive data are supplied: sepals, petals, stamens, and ovary minutely reddish-glandular. The sepals are 1.5–2 mm. long (not cm. as inadvertently stated in the original description). The filaments are subequal and much widened below. The disc is cup-shaped, regularly and deeply lobed, the lobes ovate, acute or subacute, and without indurated glands.

45. **Sabia lanceolata** Colebrooke, Trans. Linn. Soc. **12**: 355. *t. 14.* 1819; Wall. in Roxb. Fl. Ind. **2**: 309. 1824; Spreng. Syst. Veg. **1**: 779. 1825; Dietr. Synop. Pl. **1**: 804. 1839; Blume, Mus. Bot. Lugd.-Bat. **1**: 368. 1851; Hook. f. & Th. Fl. Ind. **1**: 210. 1855; Walp. Ann. Bot. Syst. **4**: 138. 1857; Hook. f. Fl. Brit. Ind. **2**: 2. 1876; Warb. in Engl. & Prantl, Nat. Pflanzenfam. **3**(5): 370. *f. 184, A–H,* 1895; Gammie, Records

Bot. Surv. Ind. **1**: 79. 1895; Collett, Fl. Simlensis 101. 1921; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 325. 1937.

An evergreen climbing shrub, the branches and branchlets slender, flexuous, mostly pale brownish; bud-scales glabrous, lanceolate, eciliate, pubescent, soon becoming glabrous or nearly so; leaves lanceolate or oblong-lanceolate, 7–16 cm. long, 2.5–5 cm. wide, acute or acuminate, acute to rounded at base, chartaceous to firmly chartaceous, pale green to olivaceous-green, glabrous except the midrib which bears a few hairs on the upper surface, glabrous and paler beneath, the margins cartilagineous, eciliate, narrowly revolute; nerves 8–12 pairs, spreading, somewhat curved, prominently arcuate-anastomosing, not very distinct above, strongly elevated beneath, the primary reticulations lax, distinct; petioles 0.5–1.5 cm. long, stout, somewhat wrinkled, slightly pubescent or glabrous; inflorescences axillary and terminal, corymbose, 4–5 cm. long, 10–20-flowered, sparsely pubescent or glabrous; peduncles 2.5–3.5 cm. long; pedicels 3–6 mm. long; bracteoles caducous; flowers greenish or greenish white, 5–7 mm. in diameter; calyx equally 5-lobed, glabrous, minutely and obscurely reddish-glandular, the lobes ovate, acute, 1 mm. long, the margins eciliate; petals 5, equal, oblong-ovate to broadly ovate-lanceolate, 3.5–5 mm. long, 1.5–2 mm. wide, 3–5-nerved, acute or obtuse, minutely reddish-glandular, the margins eciliate; stamens 5, subequal; filaments subulate, 1.5–2 mm. long, glabrous, minutely reddish-glandular; anthers ovoid, 0.2 mm. long, extrorse; disc cup-shaped, irregularly lobed, the lobes distinct, each tipped by a small indurated disciform gland; ovary subglobose or ovoid, glabrous, minutely reddish-glandular; styles slender, 0.5–0.8 mm. long, glabrous, minutely reddish-glandular; stigmas minute, rounded; carpidia blue when mature, pyriform, rounded, narrowed and often inequilateral below, 12 mm. long, 6–8 mm. wide, glabrous, only slightly compressed, the scrobiculations very obscure, the exocarp often nearly smooth, with or without persistent petals at the base.

India: Eastern Bengal, *Herb. Griffith 111* (G); Assam, "Khasia Hills," *J. D. Hooker & T. Thomson s.n.* (G); *Native Collectors* (*Herb. Calcutta*) *s.n.* (A, B, G); *Herb. Sulp. Kurz s.n.* (B, U); *G. Mann s.n.* (U); Nya Bungalow, *C. B. Clarke 37314* (U), Feb. 22, 1885, alt. 600 m.; near Mairong, *Herb. Schlagintweit 472* (G, U), Oct., 1855, alt. 850–1350 m.; Julu Bosty, *Prain's Collector 346* (A), Oct., 1898, *Simons s.n.* (B), *Col. Jenkins s.n.* (B), without collector and number (G); Manipur, *A. Meebold 6119* (P); "Khasya," *Griffiths 331* (N); Without locality, collector, or number, from *Herb. Royal Gardens, Kew* (N).

Distribution: Known only from India.

This species is characterized by its relatively large, smooth, glabrous, and irregularly subpyriform carpidia.

46. **Sabia paniculata** Edgew. in Hook. f. & Th. Fl. Ind. **1**: 211. 1855; Walp. Ann. Bot. Syst. **4**: 139. 1857; Brandis, For. Fl. N.-W. Centr. Ind. 117. 1874; Hook. f. Fl. Brit. Ind. **2**: 3. 1879; Kanj. For. Fl. School Circ. N.-W. Prov. 94. 1901; For. Fl. Siwalik Jaunsar, United Prov. 122. 1911; Duthie, Fl. Upper Gangetic Plain **1**: 183. 1903; Gamble, Manual Ind. Timb. ed. 2. 204. 1902, Reprint 204. 1911; Burkill, Records Bot. Surv. Ind. **4**: 103. 1910; Haines, Bot. Bihar Orissa **2**: 218. 1921; Osmaston, For. Fl. Kumaon 132. 1927; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 326. 1937. **Fig. 6.**

A large evergreen climber, the branches terete, striate, with a few hairs, then becoming glabrous with age; branchlets terete, striate, slender, pubescent; leaves elliptic, oblong-elliptic, broadly lanceolate, or oblong-lanceolate, 12–20 cm. long, 5–9 cm. wide, shortly acuminate or acute, broadly acute or rounded at base, coriaceous, glabrous on both surfaces, dark green on the upper surface, pale and sparsely pubescent on the midrib beneath when young, the margins cartilaginous, eciliate; nerves 3–5 pairs, curved-ascending, arched and joined by means of the secondary veins near the margin, strongly elevated beneath and with the veinlets

and reticulations prominent on both surfaces; petioles 1.5–2.5 cm. long, stout, somewhat wrinkled, pubescent or sparsely pubescent; inflorescences axillary, paniculate, usually longer than the leaves, 20–25 cm. long, pilose, sometimes bearing a few juvenile leaves, with numerous, alternate, racemosely arranged, lateral, compound cymes, the ultimate cymules 3–6-flowered, the lateral branches

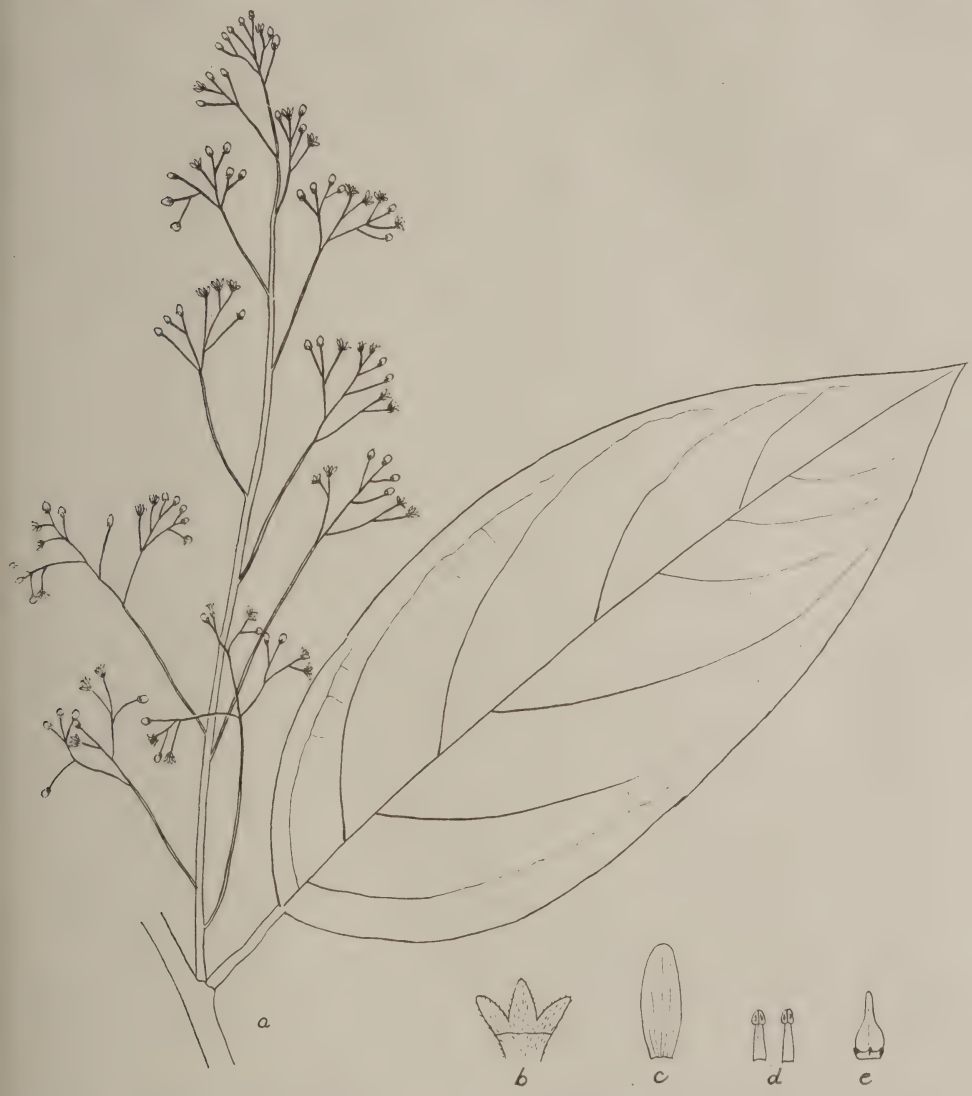

Fig. 6. *Sabia paniculata* Edgew.; *a*, a branch with leaf and inflorescence, × 1; *b*, calyx, *c*, petal, *d*, stamens, *e*, ovary, style and disc, all × 5.

2–3 cm. long; pedicels 5–8 mm. long; bracteoles pilose, linear, 1 mm. long; flowers very numerous, small, yellowish, 4–5 mm. in diameter; calyx equally 5-lobed, rather prominently pubescent and with numerous, obscure, minute, reddish-glandular dots, the lobes ovate or oblong, acute or subacute, 1 mm. long, the margins ciliate; petals 5, equal, fairly thick, oblong, 2.5–3 mm. long, up to 1 mm. wide, prominently 5-nerved, acute or obtuse, the margins eciliate; stamens

5, equal; filaments 1 mm. long, glabrous; anthers oblong, 0.5 mm. long, introrse; disc cup-shaped, slightly ribbed or folded outward, the margin shallowly 5-lobed, the lobes minute, each tipped by a small disciform indurated gland; ovary conical or ovoid, glabrous; styles 0.8 mm. long, glabrous; stigmas minute, rounded; carpidia suborbicular, inequilaterally obovate or subreniform, 7–8 mm. long, 8–9 mm. wide, glabrous, prominently scrobiculate, without persistent petals at the base.

India: United Provinces, Kumaon, *R. Strachey & J. E. Winterbottom 2* (G), alt. 600 m.; Jeolekote, *N. Gill 414* (B), Jan. 17, 1910, alt. 1400 m.; Dehra Dun, *U. Singh 172* (A, B, C, N, P), Feb. 21, 1928, flowers yellowish; *J. S. Gamble 24549* (U), Jan., 1894; Siwalik & Jaunsar Divisions, *C. S. Rawat 34* (A), in flower March 28, in fruit July 15, 1921, *A. D. Ahmad 35* (N), in 1923, flowering in March, fruiting in July, *M. L. Punj 36* (N), a large climber, flowering in March, fruiting in July, *B. N. R. Choudhury 39* (U), *M. S. Hasoi 50* (U), Feb., 1920, *R. C. Singh 54* (C), in flower March 31, in fruit April 26, 1921; Western Nepal, Garba, Doti District, *Bis Ram 249* (A, N); Northern Bengal, without locality, *K. Biswas 1694* (A, N). Upper Burma: Kachin Hills, *Shaik Mokin 60* (B, U), May, 1898.

Distribution: India (United Provinces, Western Nepal, Northern Bengal), Burma.

This species is well marked by its large leaves and its ample, many-flowered, axillary panicles, which equal or exceed the leaves in length, being made up of alternate, racemosely arranged compound cymes, the ultimate cymules 3–6-flowered.

47. **Sabia limoniacea** Wall. List no. 1000. 1829, *nomen nudum;* Hook. f. & Th. Fl. Ind. **1**: 210. 1855; Walp. Ann. Bot. Syst. **4**: 139. 1857; Kurz, For. Fl. Brit. Burma **1**: 300. 1877; Hook. f. Fl. Brit. Ind. **2**: 3. 1879; King, Jour. As. Soc. Bengal **65**(2): 454. 1896 (Mater. Fl. Malay. Penin. **2**: 740); Prain, Bengal Pl. 348. 1903; Ridley, Fl. Malay Penin. **1**: 513. 1922; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 326. 1937.

Sabia celastrinea C. Muell. in Walp. Ann. Bot. Syst. **6**: 1269. 1861 (in indice) *nomen nudum,* based on *Celastrinea* Wall. List no. 9015. 1849. **Fig. 7.**

An evergreen climbing shrub, the branches and branchlets dark brown, terete, striate, glabrous; bud-scales glabrous, ovate, the margins eciliate; leaves lanceolate or oblong, 8–17.5 cm. long, 4.5–6.5 cm. wide, acute or shortly acuminate, sometimes obtuse or subobtuse, acute to subrounded at base, coriaceous, glabrous on both surfaces, olivaceous to grayish on the upper surface, pale greenish yellow to brownish yellow or brown beneath, the margins cartilagineous, eciliate, slightly revolute; nerves 6 or 7 pairs, slender, ascending, arched-anastomosing, distinct and elevated on the lower surface, much less distinct above, the veinlets finely reticulate on both surfaces; petioles 1.5–2.5 cm. long, stout, wrinkled, glabrous; inflorescences consisting of small cymes arranged in long, narrow, axillary, solitary, glabrous, many-flowered panicles 7–15 cm. long; lateral branches stout, 5–10 mm. long, often subtended by small leaves, but in most cases the inflorescences are leafless, the individual cymules mostly 2- or 3-flowered; pedicels slightly thickened upward, 3–4 mm. long; bracteoles sparsely pubescent, linear, 1 mm. long; flowers small, 3–4 mm. in diameter, greenish white to greenish yellow, occasionally slightly pinkish; calyx equally 5-lobed, glabrous, the lobes ovate or oblong-ovate, 0.5 mm. long, acute or obtuse, the margins ciliate to subciliate; petals 5, equal, fairly thick, obovate to elliptic-ovate, 1.5–2 mm. long, 1–1.6 mm. wide, rounded, obtuse, or broadly acute, 5-nerved, the nerves obscure, the margins subciliate; stamens 5, unequal; filaments fleshy, subcompressed, 1–1.5 mm. long, glabrous; anthers minute, ovoid, 0.2 mm. long, introrse; disc cup-shaped, smooth, the margin irregularly or regularly lobed, the lobes 5, obscurely terminated by very minute indurated glands; ovary ovoid or conical, glabrous; styles short, 0.5 mm. long, glabrous; stigmas minute, somewhat rounded; carpidia obliquely orbicular to subreniform, 10 mm. in diameter,

apparently blue when mature, glabrous, the scrobiculations obscure, without persistent petals at the base.

India: Assam, "Khasia and Silhet," *J. D. Hooker & Thomson s.n.* (G, N), alt. up to 900 m.; Sylhet Station, *C. B. Clarke 18005* (P), Nov. 22, 1872; Jaboca, near Tengali Bam, and Naga Hills, *Prain's Collector 415, 626* (A), Nov., 1898 and Jan., 1899, *Col. Jenkins s.n.* (G, N). Lower Siam: Khan Pok Hill, *Md. Haniff & Md. Nur 3843* (C), Dec. 2, 1918, alt. 450 m., flowers pinkish. Sumatra: Gunong Merapi, *H. A. B. Bunnemeijer 4926* (B), Sept. 26, 1918, alt. 1150 m. China: Yunnan, Jenn-yeh Hsien, *C. W. Wang 80118* (A), Oct., 1936, alt. 980 m.; Che-li Hsien, *C. W. Wang 79409, 79501, 81027* (A), June, Sept., Oct., 1936, alt. 800–1300 m.

Fig. 7. *Sabia limoniacea* Wall.; *a*, a branch with leaf and inflorescence, × 1; *b*, an inflorescence, × 1; *c*, calyx, *d*, stamens, *e*, petal, *f*, ovary, style and disc, all × 5.

Distribution: Northern India, Burma (fide Hooker f. and Thomson), Siam, Malay Peninsula (fide King), Sumatra, China (Yunnan).

This rather widely distributed species has by no means always been correctly interpreted, and naturally it presents considerable variation. The axillary, solitary, elongated, narrow, normally rather many-flowered panicles are characteristic, the few-flowered cymules being racemosely arranged along the axis, the peduncles of the cymules often subtended by juvenile leaves. The Sumatra specimens from Gunong Merapi have smaller leaves than the specimens from India and elsewhere (7–11 × 2.5–4 cm.), and eventually, when better material

becomes available, may be otherwise disposed of, but in all characters that I consider to be essential, the collection seems to fall within the limits of Wallich's species. The specimens are incomplete in that there are no good flowers and the few small fruits appear to be abnormal.

Sabia limoniacea was a *nomen nudum* proposed by Wallich, List no. 1000. 1829, based on a specimen from Silhet; later Hooker f. and Thomson accepted the name and provided a technical description based on collections from Assam, Khasia, Silhet, and Chittagong, including Wallich's specimen. At the same time they reduced *Celastrinea* Wall. List no. 9015. 1849, based on a specimen collected by Gomez in Silhet, and to which C. Mueller, Walp. Ann. Bot. Syst. **4**: 139. 1857, assigned the binomial *Sabia celastrinea* C. Muell.

In working up the botany for the Voyage of the "Herald," Seemann, Bot. Voy. Herald 362. 1857, referred Champion's Hongkong specimen on which *Androglossum reticulatum* Champ. was based to the Indian *Sabia paniculata* Edgew. This is an error, for although *Androglossum reticulatum* Champ. is a *Sabia,* it is a species distinctly different from the one Edgeworth described. In 1861, Bentham, Fl. Hongk. 70. 1861, referred *Androglossum reticulatum* Champ. to the Indian *Sabia limoniacea* Wall., which is clearly closer to this Chinese form than is *Sabia paniculata* Edgew. I note certain differences, however, between authentic Indian specimens representing *Sabia limoniacea* Wall. and the form from southeastern China currently referred to that species, and I am of the opinion that this Kwangtung-Kwangsi-Hainan form is worthy of at least varietal rank. Dr. Merrill called my attention to the problem of the identity of *Myrsine ? ardisioides* Hook. & Arn. Bot. Beechey Voy. 197. 1836, the type of which was a fragmentary specimen from the general vicinity of Macao. A search for the type at Kew, Cambridge University, and Glasgow failed, and Dr. Merrill concluded that the type is probably no longer extant. In his treatment of the Myrsinaceae, Pflanzenr. **9** (IV. 236): 397. 1902, Mez correctly excluded the species from the Myrsinaceae, referring it with doubt to *Sabia,* and Walker, Philip. Jour. Sci. **73**: 193. 1940, excluded it from *Myrsine,* listing it as *Sabia* sp. When I was studying *Sabia limoniacea* Wall. I was reminded of certain characters assigned to *Myrsine ? ardisioides* Hook. & Arn., and from a critical consideration of all factors I am convinced that the latter species, long of doubtful status even as to its family, is the same as the form that Champion characterized as *Androglossum reticulatum.* Hooker and Arnott, in describing this Chinese form state: "Indeed, it is probable not only that the plant does not belong in *Myrsine,* but not even to the same Natural Order." I therefore propose the following disposition of this southeastern China form long placed as a synonym of *Sabia limoniacea* Wall.:

47a. **Sabia limoniacea** Wall. var. **ardisioides** var. nov.

Myrsine ? ardisioides Hook. et Arn. Bot. Beech. Voy. 197. 1836, non H.B.K. (1818), syn. nov.

Androglossum reticulatum Champ. ex Benth. in Hook. Kew Jour. Bot. **4**: 42. 1852, syn. nov.

Sabia paniculata sensu Seem. Bot. Voy. Herald 362. 1857, non Edgew. (1855).

Sabia limoniacea sensu Benth. Fl. Hongk. 70. 1861; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 144. 1886; Merr. Lingnan Sci. Jour. **5**: 119. 1928, vix Wall.

A typo differt inflorescentiis calycibusque plus minusve pubescentibus ceteroquin ut in *Sabia limoniacea* Wall.

China: Fukien, Yuen Fu Valley, *Dunn, Hongkong Herb. 2538* (A), April–June, 1905; Hongkong, *Herb. Hance 5230* (G), Oct., 1859; Kwangtung, Lofoushan, *Y.*

Tsiang 1681 (A, C, N), Dec. 21, 1928, altitude 230 m., *S. P. Ko 50106* (N), Feb. 26, 1930; Wan Tong Shan, *T. M. Tsui 402* (A, N), June, 1932, *W. T. Tsang & K. C. Wong, CCC 14575* (A, C), Oct. 17, 1926; Fan Shiu Shan, *S. K. Lau 2526* (A), Oct., 1933; Yung-Yun, *S. K. Lau 828* (A, N), Dec. 20, 1932; Wat Shui Shan, *H. D. Wong 7437* (P), Nov. 10, 1928, *Wang & Ling 7437* (C), Nov., 1928; Lokchong, *C. L. Tso 20689*[1] (B, N), May 20, 1929, *20387* (N), May 10, 1929; Ying Tak, *Y. K. Wong 527* (C), Jan. 15, 1929; Tsing Wen, *To Kang Peng CCC. 8759* (P), Jan. 20, 1922, *Y. F. Chun 30475* (N), March 23, 1930; Taai Leng Shan, *S. Y. Lau 20037* (N), March 12, 1932; Kwangsi, Bako Shan, West of Poseh, *R. C. Ching 7603* (L, N), Sept. 23, 1928, altitude 800 m.; Shap Man Taai Shan, southeast of Shang-sze, near the Kwangtung border, *W. T. Tsang 22201, 24041* (A), *24415,* TYPE (A, N), May, Aug. and Oct., 1933–1934; Tou Ngok Shan, *W. T. Tsang 23117* (A), Nov. 7, 1933; Hainan, Yaichow, Po-ting, Ng Chi Leng (Five Finger Mountains), Mo San Leng, and without locality, *N. K. Chun & C. L. Tso 44767* (A, N, U), Jan., 1933; altitude 350 m., *F. C. How 72090* (A, B), alt. 300 m., *F. A. McClure CCC 8704* (A, P), Dec. 20, 1921; *W. Y. Chun 6673* (C), *N. K. Chun and C. L. Tso 44390* (A, N), Nov., 1932, alt. 650 m., *C. Wang 35676, 35930* (A, N), Dec., 1933, *H. Y. Liang 64692, 64694* (N), Jan. 16, 1933.

DISTRIBUTION: China (Fukien, Hongkong, Kwangtung, Kwangsi, Hainan).

The varietal name *ardisioides* has been selected independently of Hooker & Arnott's use of it, but with the definite conviction that *Myrsine ? ardisioides* Hook. & Arn. represents the same entity as *Sabia limoniacea* Wall. var. *ardisioides* Chen.

This variety is apparently distinguishable from the species only by its more or less pubescent inflorescences. In leaf-size and shape, and in often having juvenile leaves on the panicle-rachis subtending the peduncles of the cymules, it parallels similar variants in the typical Indian form of the species. The flowers of this Chinese form are variously described as white, pale yellow, or yellowish white, and the young fruits as pink or red, becoming blue at maturity.

48. **Sabia javanica** (Blume) Backer in herb. comb. nov.

Meniscosta javanica Blume, Bijdr. 29. 1825.

Meniscosta scandens Blume ex Spreng. Syst. Veg. **4**(2): Cur. Post. 114. 1827; Dietr. Synop. Pl. **2**: 923. 1840 (as *Menicosta*).

Sabia Meniscosta Blume, Mus. Bot. Lugd.-Bat. **1**: 369. *t. 44.* 1851; Miq. Fl. Ind. Bat. **1**(2): 618. 1859, Ill. Fl. Archip. Ind. 71. *t. 31.* 1870; Backer, Schoolfl. Java 273. 1911.

Sabia Meniscosta Blume var. *firma* Blume, Mus. Bot. Lugd.-Bat. **1**: 370. 1851.

Sabia Meniscosta Blume var. *latifolia* Blume, Mus. Bot. Lugd.-Bat. **1**: 370. 1851.

Sabia elliptica Miq. Fl. Ind. Bat. Suppl. **1**: 203. 1860, 521. 1862.

Sabia Meniscosta Blume var. *elliptica* Miq. Ill. Fl. Archip. Ind. 71. 1870.

An evergreen scandent shrub, the branches and branchlets pale brown, terete, slender, striate, sparsely pubescent, becoming glabrous; bud-scales puberulent, ovate, the margins eciliate; leaves elliptic, oblong-elliptic, or ovate-oblong, 8–15 cm. long, 3.5–10 cm. wide, acute or shortly acuminate, apiculate, cuneate at base, chartaceous to subcoriaceous, glabrous on both surfaces, greenish on the upper surface, light brown beneath, the margins cartilagineous, narrowly revolute, eciliate, slightly wavy; nerves 4–6 pairs, curved-ascending, arched and joined remote from the margin, very strongly elevated beneath, not very prominent above, the veinlets loosely reticulate on both surfaces, strongly raised beneath; petioles 1–2.5 cm. long, somewhat wrinkled, glabrous; inflorescences axillary, narrowly paniculate, 6–10 cm. long, with many racemosely arranged 4–12-flowered cymes, shortly brownish-pubescent; branches or peduncles of the cymes

[1] A sterile specimen with numerous crowded, lateral, oblong-obovoid galls on the branches corresponding to very similar ones on a sterile specimen of the Indian *S. campanulata* Wall. (*Stewart 2258*).

slightly thickened upwards, 5–10 mm. long; pedicels slender, 1–2 mm. long; bracteoles pubescent, linear, 1 mm. long; flowers small, white, 5 mm. in diameter; calyx equally 5-lobed, rather densely pubescent, minutely and obscurely reddish-glandular, the lobes broadly ovate, 1 mm. long, acute or subacute, the margins ciliate; petals 5, equal, thin, elliptic-ovate to ovate-lanceolate or oblong, 2.5–3 mm. long, 1–1.5 mm. wide, obtuse, 3–5-nerved, the nerves red, fine but prominent, the margins eciliate; stamens 5, equal; filaments complanate, 1 mm. long, glabrous; anthers ovoid, 0.5 mm. long, introrse; disc cup-shaped, deeply lobed, each lobe obscurely tipped by minute indurated disciform glands; ovary ovoid or conical, glabrous; styles very short, 0.1–0.2 mm. long, glabrous; stigmas minute, rounded or capitate; carpidia suborbicular or subreniform, apparently white when fresh, 6 mm. long, 8 mm. wide, glabrous, finely scrobiculate, without persistent petals at the base.

Java: West Java, Bantam, Bodjongmanik, *S. H. Koorders 40805B* (B); *C. A. Backer 22081* (B), Feb., 1917, altitude 200 m.; Roempin, *Blume s.n.* (B); Batavia, Buitenzorg and vicinity, cult. *Hort. Bog. XI. B. 50* (B, P), *XVII. F. 44* (B); Koeta Pareang, *C. A. Backer 5996* (B, P), Dec. 25, 1912, altitude 400 m.; Djamboe, *C. A. Backer 23482* (B), Feb. 17, 1918, altitude 200 m.; Tjampea, without collector, *Herb. Hort. Bot. Bog. 940–5–28* (B), *R. C. Bakhuizen van den Brink 670* (B), March 20, 1918, altitude 250 m.; Laladon near Tjiomas, *R. C. Bakhuizen van den Brink 4052, 5107, 5391, 5806* (B), Aug., Jan., Feb. and Dec., 1920–1924, altitude 250–300 m.; Praeanger, Lengkong, *Doctors von Leeuwen-Reijnvaan 2871* (B), Aug. 2, 1918, altitude 575 m.; Pangerango, *Kuhl & Van Hasselt 14537* (B), altitude 1200 m.; Tjadasmalang, *W. F. Winckel 1446B* (B, C), *1604B* (B), *1680B* (C), July–Aug., 1923, altitude 1000 m.; Tjibodas, *F. Massart 774* (B, P), Jan. 26, 1895, altitude 1400 m., *Valeton s.n.* (B) in 1912; Tjigenteng, *S. H. Koorders 26249B, 26351B* (B), Jan., 1896 and 1897, altitude 1500–1700 m.; Middle Java, Banjoemas, *S. H. Koorders 34040B* (B), Aug. 24, 1900, altitude 800 m.; without locality, probably Mount Salak, *Blume s.n.* (B), apparently an isotype. Sumatra: Without locality, *H. O. Forbes 1495* [1] (G), in 1881–1882; without collector, *Herb. Hort. Bot. Bog. 940–5–85* (B); East Coast, Kota Pinang, Saboengan, *Rahmat Si Toroes 3703* (A, C); Simeloengan, near Siantan, *H. S. Yates 1200* (A, B), *1926* (B, C, N), Jan. 31, 1926, Nov. 9, 1924, altitude 300–400 m., flowers and fruit white. Borneo: Soergai, Boching, *Amdjah 126 = 1724* (B), Nieuwenhuis Exped., Dec. 28, 1898; Lianggagang, *H. Hallier 268 = 2599* (B), in 1893–1894.

Distribution: Sumatra, Java, Borneo.

The genus *Meniscosta* was proposed by Blume, Bijdr. 28. 1825, on the basis of a single species, *Meniscosta javanica*. Mr. Backer is quite in order in proposing the new name *Sabia javanica* (Blume) Backer, although we have located no actual publication of this.

The species may be recognized by its narrowly paniculate elongated inflorescences, composed of many small lateral alternate 4–10-flowered cymes, the disc being deeply lobed and without indurated glands.

Three varieties were described by Blume, Mus. Bot. Lugd.-Bat. 1: 369. 1851. *Sabia Meniscosta* Blume var. *glabriuscula* Blume from Java and Sumatra was characterized by the glabrous inflorescences. The pubescence on the inflorescences is very consistent in the typical form of this species, and therefore this variety may be maintained. *Sabia Meniscosta* Blume var. *firma* Blume of Sumatra and *Sabia Meniscosta* Blume var. *latifolia* Blume of Sumatra were differentiated from the typical form of this species on the basis of the texture and

[1] King and Gamble, Jour. As. Soc. Bengal **74**(2): 12. 1905 (Mater. Fl. Malay. Penin. **4**: 222), cite *Forbes 1495* from Sumatra as representing *Psychotria tortilis* Blume = *Streblosa tortilis* Korth. of the Rubiaceae. Baker, in his treatment of Forbes' Malayan plants, Jour. Bot. **62**: Suppl. 30. 1924, lists no representatives of the genus *Sabia*, and a year later, op. cit. 53, merely notes "King and Gamble gives *1495* from hills NE. of Goenoeng Trang, 600 feet for this" [i.e. *Streblosa tortilis* (Blume) Korth.]. Our specimen of this number is *Sabia javanica* (Blume) Backer.

size of the leaves alone. *Sabia Meniscosta* Blume var. *elliptica* (Miq.) Miq. Ill. Fl. Archip. 71. 1870, based on *Sabia elliptica* Miq., was also differentiated only by its leaf-shape, and although I have not seen any authentically named specimens representing Miquel's species or variety, with rather extensive collections available, particularly from Java and Sumatra, and from my experience with other species of this genus, I do not consider it possible to maintain this or Blume's varieties (other than var. *glabriuscula*) on the basis of leaf-shape and texture alone.

48a. **Sabia javanica** (Blume) Backer var. **glabriuscula** (Blume) comb. nov.

Sabia Meniscosta Blume var. *glabriuscula* Blume, Mus. Bot. Lugd.-Bat. **1**: 370. 1851.

Differs from the typical form of the species in its glabrous inflorescences, peduncles, and pedicels.

Java: West Java, Preanger, Tasikmalaja, Noesagede Island, Lake Pendjaloe, *Koorders 47777B, 47778B* (B), July, 1917, alt. 720 m., flowers white.

Distribution: Java and also (fide Blume) in Sumatra.

The cited specimens fall within the limits of the variety as defined by Blume, which is distinguished from the species, as far as I have been able to determine, only by its glabrous inflorescences.

49. **Sabia pauciflora** Blume, Mus. Bot. Lugd.-Bat. **1**: 370. 1851; Miq. Fl. Ind. Bat. **1**(2): 619. 1859, Ill. Fl. Archip. Ind. 72. *t. 32.* 1870.

Sabia papuana Warb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 425. 1901.

An evergreen scandent shrub, the branches blackish purple to pale greenish or whitish, terete, slender, striate, glabrous; branchlets pale, terete, slender, striate, very sparsely pubescent, soon becoming glabrous; bud-scales sparsely pubescent, ovate, the margins sparsely ciliate; leaves mostly oblong-elliptic, 6–12 cm. long, 2.5–4.5 cm. wide, shortly and usually sharply acuminate, broadly acute to subrotund at base, membranaceous to chartaceous, glabrous on both surfaces or when very young slightly pubescent, greenish olivaceous to somewhat brownish on the upper surface, paler beneath, the margins narrowly cartilagineous, eciliate; nerves 7–9 pairs, curved, arched-anastomosing, prominently elevated on the lower surface, less so above, the veinlets slender, rather distinct; petioles slender, 8–11 mm. long, sparsely pubescent when young, soon becoming glabrous; inflorescences axillary and terminal, simply cymose (2–4 cm. long) or elongated and narrowly paniculate (up to 12 cm. long), with few, scattered, racemosely arranged, few-flowered cymules even on the same specimen, in the elongated inflorescences juvenile leaves sometimes subtending the cymules, at first slightly pubescent, soon becoming glabrous, the cymules 2–4-flowered, their peduncles 1–2.5 cm. long, or the uppermost flowers racemosely arranged, the pedicels 5–7 mm. long; bracteoles slightly pubescent, linear, 2 mm. long; flowers small, pale greenish, 4–5 mm. in diameter; calyx equally 5-lobed, slightly pubescent, the lobes ovate or triangular, 0.8–1 mm. long, acute; petals 5, subequal, thin, oblong or oblong-lanceolate, 3–3.5 mm. long, 1 mm. wide, 3–5-nerved, obtuse or subacute, the margins eciliate; stamens 5, subequal; filaments flat, 1.5–2 mm. long, glabrous; anthers ovoid, 0.5 mm. long, extrorse; disc cup-shaped, irregularly shallowly lobed, without indurated glands; ovary ovoid, glabrous; styles 1 mm. long, glabrous; stigmas minute, rounded; carpidia suborbicular-obovate, pinkish white, turning to red when fresh, 7–9 mm. long, glabrous, strongly scrobiculate, without persistent petals at the base.

New Guinea: Papua (British New Guinea), Koitaki, *C. E. Carr 12624, 12625* (N), June 20, 1935, altitude 430 m., in forest, flowers pale green, fruit cream; Northeastern New Guinea, Morobe District, Sattelberg, Heldsbach, Ogeramnang, Boana, and Wantoat, *Clemens 106, 5422, 11076, 41760* (A), Feb. 3 and 17, 1935 and 1937, Sept. 11, 1935 and Aug. 28, 1940, alt. 100 to 1800 m.; Netherlands New Guinea, Bernhard Camp, Idenburg

River, *L. J. Brass 13076* (A), Feb., 1939, alt. 850 m. SOLOMON ISLANDS: Bougainville, Koniguru, Buin, and Kupei Gold Fields, *S. F. Kajewski 1670, 2028* (A, B), Apr. 10 and Aug. 7, 1930, alt. 850–950 m.

DISTRIBUTION: New Guinea, Solomon Islands, the type from the Moluccas.

The type of Blume's species was from the Moluccas, and *Sabia pauciflora* Blume was originally very inadequately described. In 1870 Miquel published an amplified and rather detailed description; this, together with his excellent plate indicating the inflorescences as few-flowered, the flowers "racemoso-paucifloris," suggests our New Guinea flowering material in that the few uppermost flowers are racemose, the lower ones in very few 2–4-flowered, racemosely arranged cymules. I have not seen Blume's type, nor have I seen the type of *Sabia papuana* Warb., which was a fruiting specimen from Northeastern New Guinea (Ramu River, *Lauterbach 2394*). While I would naturally prefer to base my interpretations on an actual examination of type material, I feel confident in this case that a reduction of *Sabia papuana* Warb. is indicated. Warburg did not discuss the alliances of his assumed new species. *Sabia pauciflora* Blume (*Sabia papuana* Warb.) is the most southern and eastern representative of the genus.

50. **Sabia reticulata** Elmer, Leafl. Philip. Bot. 2: 579. 1909; Merr. Enum. Philip. Fl. Pl. 2: 516. 1923.

An evergreen scandent shrub, the branches and branchlets dark brown, terete, slender, striate, glabrous; bud-scales glabrous, lanceolate, the margins eciliate; leaves lanceolate or oblong-lanceolate, 7–12 cm. long, 2.5–4 cm. wide, acuminate, shortly acute at base, obtuse or subrounded, subcoriaceous or chartaceous, glabrous on both surfaces, olivaceous to brownish on the upper surface, paler beneath, the margins cartilagineous, slightly wavy, eciliate; nerves 5 or 6 pairs, spreading, arched-anastomosing, prominently elevated on the lower surface, the veinlets evident on both surfaces but much more prominent beneath; petioles 1 cm. long, glabrous, occasionally sparsely pubescent; inflorescences axillary, solitary, glabrous, 2–7 cm. long,[1] consisting of a very few racemosely arranged, few-flowered cymules, their peduncles usually 5 mm. long or less, or the uppermost flowers of each inflorescence racemosely arranged; pedicels slender, up to 5 mm. long; bracteoles glabrous, lanceolate, 2 mm. long; flowers green or greenish white, small, 4 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes ovate, 1.5 mm. long, the margins ciliate; petals 5, equal, fairly thick, narrowly ovate to elliptic-ovate, broadly acute, obtuse or rounded, 2–3 mm. long, 1 mm. wide, 5-nerved, the nerves prominent, nearly parallel, the margins eciliate; stamens 5, equal; filaments flattened, mostly 0.5–1 mm. long, glabrous; anthers minute, somewhat ovoid, 0.3 mm. long, introrse; disc cup-shaped, irregularly shallowly or deeply lobed, without indurated glands; ovary ovoid or conical, glabrous; styles 0.5 mm. long, glabrous; stigmas minute, somewhat rounded; carpidia suborbicular or subreniform, blue when fresh, 8 mm. in diameter, glabrous, with obscure scrobiculations, without persistent petals at the base.

PHILIPPINES: Luzon, Laguna Province, Paete, *C. F. Baker 3699* (P), Dec. 28, 1914; Sorsogon Province, Mount Pacdal, *M. Ramos 23593* (A, B, G, N, P, U), alt. 240 m.; Mount Bulusan, *A. D. E. Elmer 15562* (A, B, C, G, N, P, U), Dec., 1915; Catanduanes, *M. Ramos 30367* (P, U), Dec. 10, 1917, alt. 60 m.; Negros, Cuernos Mountains, *A. D. E.*

[1] Elmer says in his original description: "racemes . . . 3 to 13 cm. long . . . corolla segments about 4 mm. long, nearly 2 mm. wide and stamens 2 mm. in length." This is not true of our isotype nor of any other material that I refer to this species. The inflorescences are narrow panicles rather than simple racemes, although the uppermost flowers are often racemose, mostly 2–5 cm. long, in one specimen up to 7 cm. In mature flowers the petals are 3 mm. long at most and 1.1–1.4 mm. wide, while the stamens are 0.5–1 mm. long.

Elmer 10027, ISOTYPE (G, P), *10448* (A, B, N, U); Mindanao, Davao District, Todaya, Mt. Apo, *A. D. E. Elmer 11655* (B, N, U), Sept., 1909, alt. 1200 m.; Lanao District, *M. S. Clemens 714* (A, P, U), various dates, 1907, alt. about 700 m.

DISTRIBUTION: Philippine Islands.

This species is very closely allied to *Sabia pauciflora* Blume of the Moluccas, New Guinea, and the Solomon Islands, and may be distinguished from it only with difficulty. With more abundant material from the region south and southeast of the Philippines, I should not be surprised if some future investigator reduced this Philippine species to that originally described by Blume from the Moluccas. For the present, however, it seems desirable to retain the two as distinct.

51. **Sabia kachinica** sp. nov. **Fig. 8.**

Sabia fasciculata sensu Merr. Brittonia **4**: 111. 1941, non Lecomte.

Frutex sempervirens, scandens, ramis brunneis, teretibus, striatis, glabris, ramulis plus minusve pallide viridibus; foliis oblongis vel oblongo-ellipticis, 7.5–10.5 cm. longis, 2.5–3.5 cm. latis, acute acuminatis, basi late acutis vel obtusis,

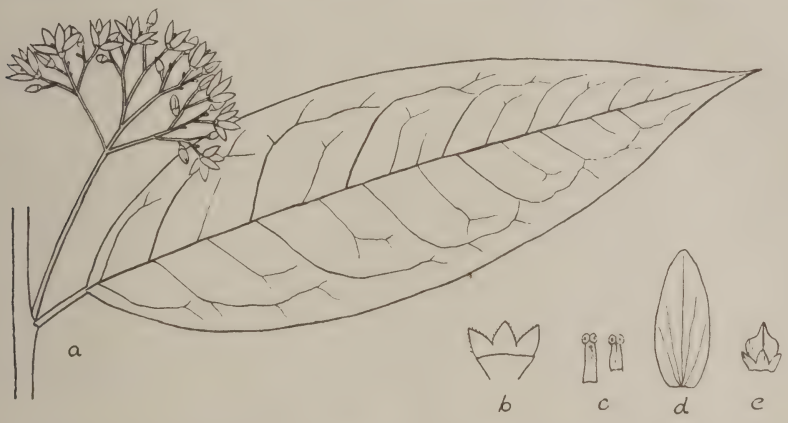

Fig. 8. *Sabia kachinica* Chen; *a,* a branch with leaf and inflorescence, × 1; *b,* calyx, *c,* stamens, *d,* petal, *e,* ovary, style and disc, all × 5.

firmiter chartaceis, utrinque nitidis, glabris, supra olivaceis vel viridibus, subtus paullo pallidioribus, margine cartilagineis, eciliatis, leviter revolutis; nervis 8 vel 9 utrinque, curvatis, arcuato-anastomosantibus, subtus perspicue elevatis, supra gracilioribus, venulis laxe reticulatis, distinctis; petiolo 6–8 mm. longo, glabro; inflorescentiis axillaribus, solitariis, longe (2–4 cm.) pedunculatis, corymboso-paniculatis, 3–4 cm. latis, glabris, 10–20-floris; pedicellis 2–3 mm. longis, gracilibus; floribus viridibus, 8 mm. diametro; calycibus glabris, lobis 5, aequalibus, ovatis, circiter 1 mm. longis, obtusis vel subacutis, margine sparse ciliatis; petalis 5, aequalibus, membranaceis, oblongo-lanceolatis vel oblongo-ellipticis, circiter 3.5 mm. longis, 1–1.3 mm. latis, 5-nerviis, acutis vel obtusis, margine eciliatis; staminibus 5, inaequalibus; filamentis complanatis, 0.7–1 mm. longis, glabris; antheris ovoideis, 0.5 mm. longis, introrsis; disco cyathiformi, irregulariter lobato, lobis 5, distinctis, oblongo-ovatis, obtusis, glandulis minutissimis induratis irregulariter disciformibus terminantibus; ovario ovoideo, glabro; stylis 0.1–0.2 mm. longis, glabris; stigmatibus minutis, subcapitatis; carpidiis ignotis.

UPPER BURMA: Kachin Hills, *F. K. Ward 9018,* TYPE (A), Dec. 3, 1930, altitude 600–1000 m., "a scrambling twiner in the jungle."

DISTRIBUTION: Burma.

This species resembles *Sabia fasciculata* Lecomte in certain aspects, but it is not closely allied to that species and may be distinguished by its much shorter styles and by its long-peduncled compound cymes that are never branched from the base.

52. **Sabia parviflora** Wall. in Roxb. Fl. Ind. **2**: 310. 1824; Spreng. Syst. Veg. **4**(2): 91. 1827; Wall. List No. 1001 in part, 1829; Dietr. Synop. Pl. **1**: 804. 1839; Hook. f. & Th. Fl. Ind. **1**: 210. 1855; Walp. Ann. Bot. Syst. **4**: 139. 1857; Hook. f. Fl. Brit. Ind. **2**: 4. 1879; Stapf, Trans. Linn. Soc. Bot. II. **4**: 142. 1894; H. Lév. Fl. Kouy-Tchéou, 379. 1915; Merr. Enum. Born. Pl. 362. 1921; Rehder, Jour. Arnold Arb. **15**: 10. 1934; Kanj. Kanj. Das & Purk. Fl. Assam **1**: 325. 1937; Chun, Sunyatsenia **4**: 242. 1940. **Fig. 9.**

Sabia sp. Griffith, Jour. **2**: 170. 1848, Notul. Pl. As. **4**: 423. 1854, Ic. Pl. As. *t. 568. II. 1–13.* 1854.

Sabia polyantha Hand.-Maz. Sinensia **3**: 190. 1933, syn. nov.

An evergreen scandent shrub, the branches terete, slender, striate, glabrous; branchlets terete, slender, striate, sparsely pubescent or glabrous; bud-scales glabrous, ovate, acute, the margins eciliate; leaves mostly ovate-lanceolate or oblong to oblong-elliptic, 5–12 cm. long, 2–4 cm. wide, distinctly acuminate, broadly acute to obtuse at base, chartaceous to thinly subcoriaceous, glabrous on both surfaces, pale brown to subolivaceous on the upper surface, paler beneath, the margins cartilagineous, often slightly wavy, eciliate (immature leaves sometimes slightly ciliate); nerves 5–8 pairs, rather spreading, arched-anastomosing, prominently elevated beneath, the veinlets distinct on the lower surface, rather obscure above; petioles 0.5–1 cm. long, sparsely pubescent or glabrous; inflorescences cymose, the individual cymes more or less compound, mostly 10–20-flowered, open, lax, 2–5 cm. in diameter, axillary and terminal, the cymes mostly solitary, occasionally arranged in racemes, the slender peduncles mostly 2–4 cm., sometimes up to 6 cm. long; pedicels slender, slightly thickened upward, 5–10 mm. long; bracteoles sparsely pubescent, linear; flowers greenish or greenish yellow, 4–6 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes ovate to oblong-ovate, about 1 mm. long, acute or obtuse, the margins minutely ciliate; petals 5, subequal, fairly thick, oblong to broadly oblong-lanceolate, 2–3 mm. long, 0.8–1 mm. wide, acute or obtuse, 3–5-nerved, the nerves reddish, the margins eciliate; stamens 5, unequal; filaments complanate, 1–1.5 or even 2 mm. long, glabrous; anthers oblong, about 0.5 mm. long, extrorse; disc cup-shaped, irregularly and often deeply lobed, the indurated glands none; ovary subconical or ovoid, glabrous; styles about 0.5 mm. long, glabrous; stigmas minute, somewhat capitate; carpidia suborbicular or subreniform, 5–7 mm. in diameter, glabrous, with obscure scrobiculations, without persistent petals at base.

India: Sikkim, *J. D. Hooker s.n.*, alt. 860–1700 m. (G), *T. Thomson s.n.* (B), in 1857, *C. B. Clarke s.n.* (A), April 26, 1876, *G. King s.n.* (B, U), Apr. 19, 1876, *G. L. Lister s.n.* (B), April, 1878, native collector, *Calcutta Bot. Gard. 1107* (P), Apr. 21, 1909, without collector in 1874, *Herb. Hort. Bot. Bog. 940.5.61* (B); Assam, Khasi Hills and Brahmaputra Plain, *Herb. S. Kurz s.n. Herb. Hort. Bot. Bog. 940.5.59* (B), without locality, collector and number (Meisner Herbarium) (N). China: Yunnan, Mengtze, *A. Henry 10400* (A, N, U), *10400A* (A), *10400B* (A, P, U), *10400D* (A, P), alt. 5000 feet; Szemao, *A. Henry 11987A* (A), alt. 400 feet; Chengkiang, *Y. Tsiang & H. Wang 16282* (A), March–May, 1939, alt. 1800–2000 m.; Lan-Tsang Hsien, *C. W. Wang 76439, 76506* (A), May, 1936, alt. 1500–1700 m.; Wen-Shen Hsien, *H. T. Tsai 51713* (A), Feb. 8, 1933, alt. 1600 m.; Lu-se, *H. T. Tsai 56968* (A), Feb. 20, 1934, alt. 1550 m.; Shang-pa, *H. T. Tsai 58757* (A), Oct. 12, 1934, alt. 2800 m.; Ping-pien Hsien, *H. T. Tsai 55142, 55358, 55461, 60043, 60575, 61450, 62284* (A), May–June, 1934, alt. 1200–1400 m.; without locality, *G. Forrest 7512, 9816* (A), *H. T. Tsai 60672* (A), in 1934; Kweichow, Chenfeng, *S. W. Teng 90865, 91041* (A), Sept. 13 and 24, 1936; Kwangsi, Bian Chen, *R. C. Ching 6720*, isotype of *Sabia polyantha* Hand.-Maz. (L, N), Aug. 5, 1928, alt. 3000 feet, *R. C. Ching 6718* (L, N),

Aug. 5, 1928, alt. 2800 feet; Lui Yuin Hsien, *A. N. Steward & C. C. Cheo 503, 578* (A, B, N), May 24, June 3, 1933, alt. 1000 m. INDO-CHINA: Tonkin, *A. Pételot 4433* (N, U), Aug., 1933, alt. 1300 m., *5443* (A, N), April, 1935, alt. 1450 m. BRITISH NORTH BORNEO: Mount Kinabalu, Penibukan, *J. & M. S. Clemens 40803* (A, U), Oct. 19, 1933, alt. 5000–6000 feet; Tenompok, *J. & M. S. Clemens 29640* (A, B, N, P), May 10, 1932, alt. 3000–4000 m.

DISTRIBUTION: India, China (Yunnan, Kweichow, Kwangsi), Indo-China, Borneo.

This species is in general distinguished by its slenderly peduncled, lax, rather many-flowered cymes and its obscurely and minutely reddish-glandular ovaries. It is widely distributed, extending from Sikkim in India eastward to Yunnan,

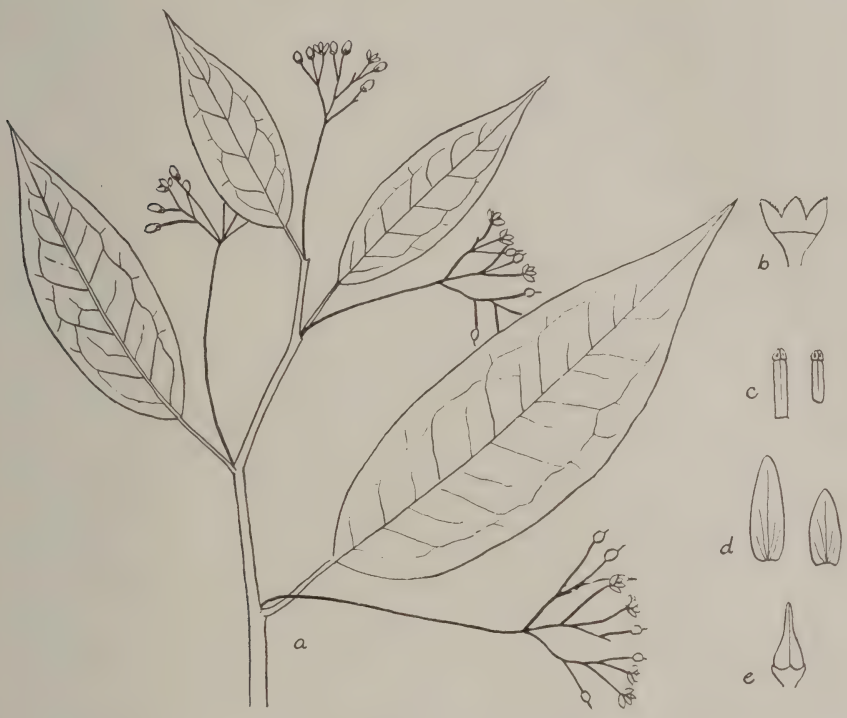

Fig. 9. *Sabia parviflora* Wall.; *a*, a leafy branch with inflorescences, × 1; *b*, calyx *c*, stamens, *d*, petals, *e*, ovary, style and disc, all × 5.

Kweichow, and Kwangsi in China and southward to Indo-China and British North Borneo.

Griffith's *Sabia* sp. is reduced from an examination of his illustration and description, as the characters indicated by him conform to those of Wallich's species. I have seen no specimens collected by him. *Ching 6720,* an isotype of *Sabia polyantha* Hand.-Maz., conforms fairly well with our Indian material and the published descriptions, and accordingly I do not hesitate to reduce Handel-Mazzetti's species; he compared it with *Sabia lanceolata* Colebr. and *S. Swinhoei* Hemsl. but not with *Sabia parviflora* Wall.

52a. **Sabia parviflora** Wall. var. **nitidissima** H. Lév. Fl. Kouy-Tchéou 379. 1915; Rehder, Jour. Arnold Arb. **15:** 10. 1934.

Celastrus Esquirolii H. Lév. Rep. Sp. Nov. **13:** 262. 1914.

The variety differs from the typical form of the Indian species by its larger leaves, 10–18 cm. long, 2.5–5 cm. wide, ovate-oblong, lanceolate-oblong or lanceolate, lustrous on the upper surface and less lustrous beneath, the nerves often more prominent and more numerous, often up to 10 pairs.

China: Kweichow, without locality, *J. Esquirol s.n.*, August, 1905 (holotype of *Celastrus Esquirolii* H. Lév. and *Sabia parviflora* var. *nitidissima* H. Lév., merotype A); Lo-fou, *J. Cavalerie 3415*, fragment and photo. (A), August, 1909; route de Mou-you-se à Kouan-lin, *J. Cavalerie 3919*, fragment and photo. (A), July 25, 1912; Yunnan, Feng Chen Lin Mountain, south of the Red River near Mengtze, *A. Henry 10400C* (A, N), alt. 2100 m.; Kien-shuei Hsien, *H. T. Tsai 53345* (A), May 7, 1933, alt. 1600 m. Siam: Region of Chieng Rai, Chiengmai Province, upper slopes of Doi Chang Mountain, *J. F. Rock 1774* (A, C, U), Jan. 11, 1922, alt. from 1260 to the summit 1765 m. Burma: Southeastern Shan States, Keng Tung Territory, between Ban Yang Kha and Pang Hoi Phi Bang, Valley of the Meh Len, *J. F. Rock 2202* (A, C, U), Jan. 30, 1922.

Distribution: China (Kweichow, Yunnan), Siam, Burma.

52b. **Sabia parviflora** Wall. var. **Harmandiana** (Pierre) Lecomte, Bull. Soc. Bot. Fr. **54**: 673. 1907, *in nota*, Fl. Gén. Indo-Chine **2**: 2. 1908, *in nota*.

Sabia Harmandiana Pierre, Fl. For. Cochinch. **5**: *pl. 360B*. 1897; Craib, Fl. Siam. Enum. **1**: 340. 1926.

Sabia parviflora sensu Lecomte, Fl. Gén. Indo-Chine **2**: 2. *t. 1*, 1908, vix Wall.

Differs from the typical form of Wallich's species, as far as I can determine, only by its constantly but often only very sparsely pubescent inflorescences.

China: Yunnan, Szemao, *A. Henry 11987* (A, N), alt. 1200 m.; watershed of the Black River, or Papienho, between Mohei and Maokai, *J. F. Rock 2905* (A, C, U), Mar. 20, 1922, alt. 1500 m.; Fo-Hai, *C. W. Wang 74401* (A), June, 1936, alt. 1530 m.; Lan-Tsang Hsien, *C. W. Wang 76413* (A), May, 1936, alt. 1600 m.; Shunning, *T. T. Yü 16308, 16507* (A), June 16–25, 1938, alt. 1600–1900 m. British North Borneo: Mount Kinabalu, Tenompok, *J. & M. S. Clemens 28149* (A, B, N), *28493, 28755, 34092* (A, B), January, February, March, July, 1932, alt. 5000 feet.

Distribution: China (Yunnan), Indo-China (fide Lecomte), Siam (fide Craib), Borneo.

The treatment of *Sabia Harmandiana* Pierre by Lecomte, Fl. Gén. Indo-Chine **2**: 2. 1908, is not altogether clear, as this binomial is at first listed by him as a straight synonym of *Sabia parviflora* Wall. on page 2; but on page 3 he states: "La plante désignée par Pierre sous le nom de *S. Harmandiana* n'est que la variété *Harmandiana* de l'espèce précédente [*Sabia parviflora* Wall.] dont elle diffère seulement par la plus grande taille des feuilles et la pilosité de l'inflorescence." It is clear, however, from his comment in Bull. Soc. Bot. Fr. **54**: 673. 1907, that he actually meant Pierre's species to stand as a variety. Craib, Fl. Siam. Enum. **1**: 340. 1926, accepted *Sabia Harmandiana* Pierre as a valid species on the basis that it has somewhat larger leaves and that its inflorescence is constantly hairy, *Sabia parviflora* Wall. being glabrous. In my opinion this form is scarcely worthy of specific rank and I retain it as a very weak variety of *Sabia parviflora* Wall. The pubescence on the inflorescences is sparse and is never very conspicuous. Pierre's figure of the ovary and disc, reproduced also by Lecomte, shows the disc-lobes relatively longer than in any flowers I have examined; their length is probably exaggerated.

The Borneo specimens, *Clemens 28149, 28493, 28755, 34092*, that I refer here have the very young leaves somewhat pubescent, while the inflorescences are somewhat more pubescent than in our Indo-Chinese specimens that I accept as representing typical *Sabia parviflora* Wall. var. *Harmandiana* (Pierre) Lecomte. The flowers of the Bornean specimens are quite the same as those from Indo-China. For the present I am content to treat the cited Bornean specimens as belonging to *Sabia parviflora* Wall. var. *Harmandiana* (Pierre) Lecomte.

53. **Sabia philippinensis** C. B. Robinson, Bull. Torrey Bot. Club **35**: 70. 1908; Merr. Enum. Philip. Fl. Pl. **2**: 516. 1923.

An evergreen, glabrous, scandent shrub, the branches terete, grayish to brownish or purplish brown, striate; branchlets terete, slender, flexuous, striate, pale yellowish green to brownish; bud-scales minute, glabrous, ovate, shortly acute or obtuse, the margins eciliate; leaves coriaceous or somewhat chartaceous, lanceolate to oblong-lanceolate, usually 3–7 cm. (rarely up to 9 cm.) long, 1–2.5 cm. (sometimes 3 cm.) wide, acute or acuminate and usually mucronate, acute to obtuse at base, the upper surface pale greenish olivaceous to dark brown-olivaceous, the lower surface paler, the margins cartilagineous, slightly wavy, eciliate; primary veins on each side of the midrib 7–12, spreading at nearly right angles, arched-anastomosing, distinctly elevated and prominent on the lower surface as are the distinct primary reticulations; petioles glabrous, 6–10 mm. long, slender; cymes solitary, mostly axillary or axillary and terminal, peduncled, 2–4 cm. long, subcompound, 1–2 cm. in diameter, 4–10-flowered; peduncles slender, 1–3 cm. long; pedicels slender, 2–4 mm. long; bracteoles sparsely pubescent, linear, 1 mm. long, acute, the margins minutely ciliate; flowers pale green to white or yellowish green, small, about 4 mm. in diameter; calyx equally 5-lobed, glabrous, the lobes ovate, about 1 mm. long, acute or obtuse, the margins minutely ciliate; petals 5, equal, ovate to oblong, with 5 prominent nerves, about 2 mm. long, 1–1.3 mm. wide, obtuse, rounded or rarely subacute, the margins eciliate; stamens 5, slightly unequal; filaments 1–1.5 mm. long, comparatively thick; anthers minute, ovoid, about 0.5 mm. long, introrse; disc cup-shaped, distinctly lobed, the lobes small, acute, without indurated glands; ovary ovoid; styles very short or none, never more than 0.2 mm. long, glabrous; stigmas minute, rounded; fruit unknown.

PHILIPPINES: Luzon, Ilocos Norte Province, Mt. Nagapatan, *M. Ramos 33240* (N, P), Aug. 8, 1918; Province of Abra, Mt. Posuey, *M. Ramos 26973* (A, B, P, U), Feb. 5, 1917; Bontoc Subprovince, Mt. Caua, *M. Ramos & G. Edaño 37994* (A, B, P, U), Mar. 4, 1920; Benguet Province (or Subprovince), Baguio, *A. D. E. Elmer 5866* (A, B, P, U), *8420, 8587* (A, B, N, U), Mar. 11, 1904 and March, 1907, *R. S. Williams 1445*, TYPE (N), isotype (P, U), Nov. 8, 1904, *E. D. Merrill 7708* (U), May, 1911; Mount Ugo, *M. Ramos 5822* (P, U), Dec. 19, 1908; Pauai, *J. K. Santos 31674* (A, B, P), May 10, 1918, *M. Ramos & G. Edaño 45052* (A, C, N, P), Mar. 12, 1925, in forests, alt. 1500–2300 m.

DISTRIBUTION: Philippines.

Robinson described the fruit as baccate, 1.5 cm. long and nearly 1 cm. in diameter, tipped by the persistent stigma, 2-celled. The fruits on the type specimen impress me as being abnormal, apparently due to having been stung by an insect, and I have hence ignored them in my description. The two on the holotype, one attached, are ovoid, equilateral, smooth, fleshy when fresh, and internally entirely modified, the pericarp being fleshy and much thickened; they are crowned by small imbricate scale-like appendages which surround the very obscure styles. All the other specimens examined are in anthesis, none having fruits. The species is not allied to *Sabia Swinhoei* Hemsl., to which Robinson compared it, but is very close to *Sabia parviflora* Wall. One outstanding character appears to be the almost entire absence of the style. The floral, anatomical, and pollen characters are wholly those of *Sabia*.

DOUBTFUL AND EXCLUDED SPECIES

SABIA ACUTISEPALA Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 78. 1936, in clavis Japonice, *nomen nudum*.

The only specimen in the species cover at Kew is *Henry 5265* from Changyang, Hupeh, which Lecomte had determined as representing *Sabia purpurea* Hook. f. & Th. Stapf added: "Certe non *Sabia purpurea*." Of this I have seen

only a flower and a photograph of the type sheet, and I can express no opinion as to the validity and relationship of the proposed species. It apparently belongs in the section *Pachydiscus*. The binomial appears in botanical literature merely as a *nomen nudum*.

SABIA CAVALERIEI H. Lév. Rep. Sp. Nov. **9**: 456. 1911.

This species was based on *J. Cavalerie 22 bis* from Kweichow and was correctly reduced by Rehder, Jour. Arnold Arb. **14**: 224. 1933, to *Orixa japonica* Thunb. of the Rutaceae.

SABIA DENSIFLORA Miq. Fl. Ind. Bat. Suppl. **1**: 520. 1862.

This species, based on a specimen from Sumatra, was reduced by Koorders and Valeton to *Meliosma angulata* Blume, Meded. Lands Plant. **61**: 131. 1903 (Bijdr. Boomsoort. Java **9**: 131), *Meliosma* being another genus of the Sabiaceae.

SABIA EDULIS H. Lév. Fl. Kouy-Tchéou 379. 1915, *nomen nudum*.

Based on *J. Cavalerie 2033*, in part, *3904, 3932*, from Kweichow, and reduced by Rehder, Jour. Arnold Arb. **15**: 2. 1934, in part to *Iodes ovalis* Blume and in part to *Iodes Seguini* (H. Lév.) Rehder, of the Icacinaceae.

SABIA ESQUIROLII H. Lév. Rep. Sp. Nov. **9**: 457. 1911.

Based on *J. Esquirol 416* from Kweichow, and correctly reduced by Rehder, Jour. Arnold Arb. **15**: 309. 1934, to *Gardneria multiflora* Nakai of the Loganiaceae.

SABIA FEDDEI H. Lév. Rep. Sp. Nov. **9**: 456. 1911.

Based on *J. Cavalerie 23 bis* from Kweichow, and correctly reduced by Rehder, Jour. Arnold Arb. **14**: 224. 1933, to *Orixa japonica* Thunb. of the Rutaceae.

SABIA ? FLORIBUNDA Miq. Fl. Ind. Bat. Suppl. **1**: 520. 1862.

This species, based on specimens from Sumatra, was reduced to *Meliosma angulata* Blume by Koorders and Valeton, Meded. Lands Plant. **61**: 131. 1903 (Bijdr. Boomsoort. Java **9**: 131).

SABIA VIRIDISSIMA Kurz, Jour. As. Soc. Bengal **41**(2): 304. 1872.

Kurz's species was based on material from the Andaman Islands and is the basis of *Blachia viridissima* (Kurz) King, Jour. As. Soc. Bengal **65**(2): 455. 1896 (Mater. Fl. Malay. Pen. **2**: 741.), *in nota*, of the Euphorbiaceae. King states that Kurz's specimens, in part, represent *Erythropalum scandens* Blume, of the Olacaceae, but his description seems safely to have been based wholly on the euphorbiaceous plant. Incidentally, *Blachia viridissima* (Kurz) King was overlooked by the compilers of the supplements to Index Kewensis, while Pax and Hoffmann, Pflanzenr. **47**(IV. 147. III): 36–39, 1911, in their monographic treatment of the seven known species of *Blachia*, fail to account for it. *Blachia viridissima* (Kurz) King differs from the single other Andaman Islands species, *B. andamanica* Hook. f., by its paniculate inflorescences, its 3-cleft styles, and its membranaceous, obovate, or elliptic-lanceolate leaves.

SABIA ROTUNDATA Stapf (err. "Dunn") ex Anon. Acta Phytotax. Geobot. **5**: 77. 1936, *nomen nudum*.

There are two specimens in the species cover at Kew, *Wilson 3141* (Veitch Expedition), May, 1904, and *Wilson 329* from Patung, Hupeh, April, 1900, both described as scandent and with brownish flowers. No. *3141* was determined by Lecomte as representing *Sabia yunnanensis* Franch. I have seen no material of

Wilson 329, while the Arnold Arboretum specimen of *Wilson 3141* is wholly inadequate, having only a few very immature leaves and two immature flower-buds. The species, whatever it may prove to be, is clearly a deciduous one, but I can not place it on the basis of the fragmentary and incomplete material available to me. In Stapf's manuscript key it is contrasted to *Sabia emarginata* Lecomte thus: "Sepals truncate or emarginate: young leaves quite glabrous. . . . *S. emarginata*" and "Sepals rounded: leaves with a very few minute appressed hairs or glabrous . . . *Sabia rotundata,*" both being placed under a division "Flowers precocious on short shoots with the young leaves; peduncles rather short." Like *Sabia acutisepala* Stapf, this binomial appears in botanical literature only as a *nomen nudum.*

List of cited specimens

All specific names pertain to *Sabia.*

Ahmad (India) 35 paniculata.
Amdjah (Borneo) 126 = 1724 javanica; 883 racemosa.
Backer (Java) 5996, 22081, 23482 javanica.
Baker (Philippines) 3699 reticulata.
Bakhuizen van den Brink (Java) 670, 5107, 5391 javanica.
Bis Ram (India) 249 paniculata; 364 campanulata; 2302 paniculata.
Biswas (India) 1694 paniculata.
Blume (Java) s.n. javanica.
Boeea (Sumatra) 7127 sumatrana.
Brass (New Guinea) 13076 pauciflora.
Bünnemeijer (Sumatra) 4926 limoniacea.
Carr (New Guinea) 12624, 12625 pauciflora.
Chen (China) 970 Swinhoei.
Cheng (China) 4507 japonica.
Cheo & Wilson (China) 12823 japonica.
Ching (China) 1722 discolor; 1764, 2391, 3409 gaultheriifolia; 2006 Swinhoei var. subcorymbosa; 5792 fasciculata; 6718, 6720 parviflora; 7603 limoniacea var. ardisioides; 20231 Croizatiana; 20685 yunnanensis var. Mairei.
Ching & Tso (China) 496 japonica.
Choudhury (India) 39 paniculata.
Chow (China) 313, 323, 654 Schumanniana.
Chun, N. K. & Tso (China) 44350, 44390, 44767 limoniacea var. ardisioides.
Chun, W. Y. (China) 6673 limoniacea var. ardisioides.
Chun, Y. F. (China) 30475 limoniacea var. ardisioides.
Chung (China) 3191, 6635 Swinhoei; 3276 discolor; 3409 gaultheriifolia; 8023, 8043 japonica.
Chung & Sun (China) 627, 735 gaultheriifolia.
Clarke (India) 18005 limoniacea; 26933 leptandra; 37314 lanceolata.
Clemens, M. S. (New Guinea) 106, 5422, 11076 pauciflora; (Philippines) 714 reticulata.
Clemens, J. & M. S. (Borneo) 28149, 28493, 28755, 34092 parviflora var. Harmandiana; 29640, 34092, 40803 parviflora; 26192, 30374, 30375, 30631 racemosa.
Craib (India) 4700 leptandra.
Dickason (Burma) 7480 falcata.
Drummond (India) 2023, 21451 campanulata.
Ducloux (China) 6, 104 bicolor; 117 yunnanensis var. Mairei.
Dunn (Hongkong Herb.) 2533 Swinhoei; 2534 coriacea; 2535 japonica; 2536, 2537 discolor; 2538 limoniacea var. ardisioides.
Elmer (Philippines) 5866, 8420, 8587 philippinensis; 10027, 10448, 11655, 15562 reticulata.
Faber (China) s.n. japonica.
Fan & Li (China) 82 japonica.
Fang (China) 1327, 2178 gracilis; 1388 puberula; 2178 Schumanniana var. longipes.
Feng (China) 746, 817, 962 yunannansis var. Mairei; 792, 1065 yunnanensis; 1834 glandulosa.
Forbes (Sumatra) 1495 javanica.

FORREST (China, Burma) 2096 pp., 4721, 4726 yunnanensis; 4707, 19379 Croizatiana; 5574 yunnanensis var. Mairei; 7512, 9816 parviflora; 8469, 9569, 9717, 21091 dumicola; 17799 fasciculata; 21472 angustifolia.
FU (China) 79 Swinhoei.
GAMBLE (India) 24549 paniculata.
GILL (India) 414 paniculata.
GRESSITT (China) 1249 discolor; 1718 coriacea.
GRIFFITH (India) 111, 331 lanceolata.
HALLIER (Borneo) 268a = 2599 javanica.
HANCE (China) 5230 limoniacea var. ardisioides.
HANDEL-MAZZETTI (China) 87 heterosepala; 103 Swinhoei; 1066 yunnanensis.
HASSI (India) 50 paniculata.
HENRY (China) 3460, 3460A, 4181 Swinhoei; 4045 puberula; 5265 acutisepala; 5314 emarginata; 5421, 5421B, 6114 Schumanniana; 6022, 6227, 7240 gaultheriifolia; 6290 puberula var. hupehensis; 6780 Ritchieae; 10250 olacifolia; 10400, 10400A, 10400B, 10400D parviflora; 10400C parviflora var. nitidissima; 10487 fasciculata; 10496, 10529, 10529A, 11987A pallida; 11987 parviflora var. Harmandiana.
HOOKER (India) s.n. parviflora; s.n. leptandra; s.n. campanulata.
HOOKER & THOMSON (India) s.n. limoniacea; s.n. purpurea; s.n. lanceolata.
HOW (China) 72090 limoniacea var. ardisioides.
HU (China) 869 japonica; 946 discolor.
JENKINS (India) s.n. limoniacea; s.n. lanceolata.
KAJEWSKI (Solomon Islands) 1670, 2028 pauciflora.
KENG (China) 565, 622 japonica.
KING (India) 5105, s.n. leptandra; s.n. parviflora.
KING'S COLLECTOR (Malay Peninsula) 2217 sumatrana.
KOELZ (India) 1470, 1775 campanulata.
KOORDERS (Java) 26248, 26351, 34040, 40850 javanica; 47777, 47778 javanica var. glabriuscula.
KORTHALS (Sumatra) s.n. sumatrana.
KUHL & VAN HASSELT (Java) 14537 javanica.
KUNTZE (India) 6830 leptandra.
KURZ (herb.) (India) s.n. lanceolata; s.n. parviflora.
LAU (China) 828, 2526 limoniacea var. ardisioides; 2718 coriacea; 4152 japonica var. sinensis; 4464 japonica; 25751 Swinhoei var. hainanensis; 28443 fasciculata.
LIANG (China) 64692, 64694 limoniacea var. ardisioides.
LING (China) 7825, 12400, 12426 japonica.
LISTER (India) s.n. parviflora.
MAIRE (China) 281 yunnanensis; 326, 335, 3639, 3839 Croizatiana; 357, 3320 Rockii; 541, 1489 yunnanensis var. Mairei; s.n. Schumanniana.
MANN (India) s.n. lanceolata.
MASSART (Java) 774 javanica.
MAXIMOWICZ (Japan) s.n. japonica.
MCCLURE (China) 6480 Swinhoei; 6754 discolor; 8704 limoniacea var. ardisioides.
MEEBOLD (India) 6119 lanceolata.
MERRILL (Philippines) 7708 philippinensis; (China) 10745 Swinhoei; 11438 japonica.
MEYER (China) 1539 Swinhoei.
MOKIM (India) 60 paniculata.
NANKING UNIV. (China) 1590 japonica.
NATIVE COLLECTOR (Calcutta Bot. Gard.) (India) 1107 parviflora.
NORTON (China) 1477 Swinhoei.
PARKER (India) 3055, s.n. campanulata.
PENG (China) 8759 limoniacea var. ardisioides.
PÉTELOT (Indo-China) 1774, 2182, 2183, 3069, 3793 olacifolia; 4433, 5443 parviflora; 4531 fasciculata.
PRAIN'S COLLECTOR (India) 346 lanceolata; 415, 626 limoniacea.
PUNJ (India) 36 paniculata.
PURDOM (China) 894 shensiensis.
QURESHI (India) 28 campanulata.
RAMOS (Philippines) 5822, 26973, 33240 philippinensis; 23593, 30367 reticulata.
RAMOS & EDAÑO (Philippines) 37994, 45052 philippinensis.
RAWAT (India) 34 paniculata.

ROCK (China, Siam, Burma) 1774, 2202 parviflora var. nitidissima; 2905 parviflora var. Harmandiana; 3114 p. p., 4243, 4793 yunnanensis; 3114 p. p., 3120, 3531, 3672, 3732 yunnanensis var. Mairei; 8334 Rockii; 24718 Croizatiana.
RUSE (India) 5 purpurea.
SAKURAI (Japan) s.n. japonica.
SANTOS (Philippines) 31674 philippinensis.
SCHLAGINTWEIT (India) 472 lanceolata.
SCHNEIDER (China) 637, 998, 1261, 2987 yunnanensis.
SCORTECHINI (Malay Peninsula) s.n. sumatrana.
SIMONS (India) s.n. lanceolata.
SIN (China) 9799 discolor.
SINGH, R. C. (India) 54 paniculata.
SINGH, U. (India) 172 paniculata.
STEWARD & CHEO (China) 171, 712 brevipetiolata; 503, 578 parviflora; 889 Swinhoei var. subcorymbosa.
STEWART (India) 2026, 2258, 12099, 13112, s.n. campanulata.
STRACHEY & WINTERBOTTOM (India) 1, 3 campanulata; 2 paniculata.
TAAM (China) 54 Swinhoei.
TASHIRO (Japan) s.n. japonica.
TEN (China) 357 Croizatiana; 544 yunnanensis var. Mairei.
TENG (China) 90865, 91041 parviflora.
THOMSON (India) s.n. parviflora; s.n. leptandra; s.n. campanulata.
TO (China) 2806 japonica; 8759 limoniacea var. ardisioides.
TO, TSANG & TSANG (China) 12787, 12847 japonica.
TOROES (Sumatra) 3703 javanica.
TSAI (China) 50982 Schumanniana; 51629, 51660, 51695, 51755, 51904, 55103, 57017, 60613, 60821 fasciculata; 51713, 55142, 55358, 55461, 56968, 58757, 60063, 60575, 60672, 61450, 62284 parviflora; 53037 Croizatiana; 53116, 60912, 60982, 61010, 62823 olacifolia; 53345 parviflora var. nitidissima; 54582, 55007 Metcalfiana; 55528 dumicola; 57011 yunnanensis var. Mairei; 57022 acuminata; 57132, 57267, 57328 callosa; 62774 Dielsii; 62875 pentadenia.
TSANG (China) 20203, 20312, 22698, 26232 Swinhoei; 20633, 21223, 25026, 25159, 28579 discolor; 21362, 25510 coriacea; 22201, 24041, 24415 limoniacea var. ardisioides; 28146, 23657 japonica; 26254 japonica var. sinensis.
TSANG & WONG (China) 14575 limoniacea var. ardisioides.
TSIANG (China) 1681 limoniacea var. ardisioides; 4630 brevipetiolata; 5072, 5306, 6155 gracilis; 9952 japonica; 10082 Swinhoei; 41415 bicolor.
TSIANG & WANG (China) 16281 bicolor; 16282 parviflora.
TSO (China) 20387, 20689 limoniacea var. ardisioides; 20434 discolor; 20930 japonica var. sinensis; 21068 fasciculata.
TSOONG, K. K. (China) 3273 p. p. japonica; 3434 Swinhoei.
TSOONG, T. S. = CHUNG, Z. S. (China) 81700 japonica.
TSUI (China) 388 discolor; 402 limoniacea var. ardisioides; 679 japonica var. sinensis.
VALETON (Java) s.n. javanica.
WALLICH (India) 1001 p. p. parviflora; 1001 p. p. purpurea; 1002 campanulata.
WANG, C. (China) 35676, 25930 limoniacea var. ardisioides; 39425, 40326 fasciculata; 40857 Wangii.
WANG, C. W. (China) 71939, 72476, 72531 dumicola; 74401, 76413 parviflora var. Harmandiana; 76439, 76506 parviflora; 79409, 79501, 80118, 81027 limoniacea.
WANG, F. (China) 23045 Schumanniana.
WANG, F. T. (China) 20846 omeiensis.
WANG, H. (China) 41415 bicolor.
WANG & LING (China) 7437 limoniacea var. ardisioides.
WARD (Burma) 376 fasciculata; 9018 kachinica.
WILLIAMS (Philippines) 1445 philippinensis.
WILSON (China, Japan, Formosa, India) 184 Swinhoei var. subcorymbosa; 329 rotundata; 582, 2534 Schumanniana var. pluriflora; 818, 2530, 2531 latifolia; 860 Schumanniana; 1728 emarginata; 2529 Schumanniana var. longipes; 2532, 4806 gracilis; 2533, 6780 Ritchieae; 2534A, 2534B puberula; 3141 rotundata; 6139, s.n. japonica; 10035, 10936 transarisanensis; s.n. leptandra.
WINCKEL (Java) 1446, 1604, 1680 javanica.
WINKLER (Borneo) 2948 racemosa.

Wong, H. D. (China) 7437 limoniacea var. ardisioides.
Wong, Y. K. (China) 527 limoniacea var. ardisioides.
Yates (Sumatra) 1200, 1926 javanica.
Yü (China) 253, 837 gracilis; 382, 613, 662, 779 omeiensis; 5231 pubescens; 10023, 15975 Yuii; 15500 yunnanensis var. Mairei; 16171 acuminata; 16308, 16507 parviflora var. Harmandiana; 16821 olacifolia; 17082 parvifolia.

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THE CHINESE AND INDO-CHINESE SPECIES OF ORMOSIA

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Ormosia was proposed and described by Jackson in 1811,[1] based on three species from British Guiana and the West Indies, *Ormosia coccinea* Jacks., *O. dasycarpa* Jacks., and *O. coarctata* Jacks. The genus may be typified by the first species; the other two are safely congeneric with it, and of these *O. dasycarpa* Jacks. is a synonym of the West Indian *Ormosia monosperma* (Sw.) Urban. These species are all characterized by having red seeds with a small or large black spot, a character that holds for many of the American species, but which appears in only a very few Old World species, *Ormosia macrodisca* Baker and *O. gracilis* Prain of the Malay Peninsula, and *O. Clementis* Merr. of the Philippines. Since the genus was proposed, between ninety and one hundred species have been described from tropical America, the tropical and subtropical parts of Asia, and from Malaysia and Africa. About half of these were based on material originating in the Old World, eleven from China alone. Eliminating those species which were later found to represent genera other than *Ormosia* and those that have legitimately been reduced to synonymy within *Ormosia*, there remain about seventy-five species of the genus that are currently accepted as valid. Adding the eighteen species described as new in this paper brings the total of reasonably valid species to over ninety, as the genus is now constituted. This is in rather striking contrast to the situation up to nearly the end of the last century, for in 1865 Bentham's estimate for the entire world was eighteen species, which Taubert increased to about twenty in 1892.

Recent extensive explorations in southern, southwestern, and western China have greatly increased the herbarium resources of the Arnold Arboretum, and in the collections received a considerable number of species of *Ormosia* are represented. It was therefore considered expedient to attempt a general revision of the Chinese species of the genus. For convenience we have also included the Indo-Chinese species, eight having been previously recorded from that country, this number being now increased to twelve; of these twelve species six are endemic, as far as now known, while six extend to China. We have also included the single Formosan species.

Ormosia Jackson is accepted without question as the proper generic name for this group. Clearly the older *Toulichiba* Adanson, Fam. 2: 326. 1763, is a synonym of *Ormosia*, as Plumier's illustration, on which Adanson's name was wholly based, represents the West Indian *Ormosia monosperma* (Sw.) Urban, and *O. dasycarpa* Jacks. is a synonym of that species. As Adanson's generic name was published without a binomial, and as no binomials have ever appeared under it, no reason exists for its acceptance in preference to *Ormosia* Jackson; in any case *Ormosia* Jackson (1811) is conserved against *Toulichiba* Adanson (1763) under the provisions of the International Code of Botanical Nomenclature, ed. 2, 98. 1935.

[1] **Jackson, G.** An account of Ormosia, a new genus of decandrous plants belonging to the natural order Leguminosae. Trans. Linn. Soc. **10:** 358–362. *t. 25–27.* 1811.

Macrotropis de Candolle, Prodr. 2: 98. 1825, was placed as a synonym of *Ormosia* Jackson by Bentham and Hooker f., Gen. Pl. 1: 556. 1865, but is better placed under *Sophora* Linn. Its basis was *Anagyris* sensu Loureiro, non Linn. Of the two species assigned to it by de Candolle, *Anagyris foetida* Lour. = *Macrotropis foetida* DC. is a synonym of *Sophora japonica* Linn., according to Merrill, Trans. Am. Philos. Soc. II. 24(2): 193. 1935, while *Anagyris inodora* Lour. = *Macrotropis inodora* DC., a species of somewhat doubtful status, very likely based on flowers of one species and fruits of another, appears in part to be a *Sophora,* probably *S. japonica* Linn. Merrill, l.c., calls attention to the fact that the Annamese name, given by Loureiro as *cay-hay,* is clearly a cognate form of *cay-hoe,* listed by Gagnepain as the name of *Sophora japonica* Linn. Merrill left the species as doubtfully representing a *Sophora,* thinking this not an impossible reduction if one excludes Loureiro's fruit description. It may be noted in passing that the one species of *Ormosia* that Loureiro did describe was placed by him in the totally unrelated genus *Cynometra, C. pinnata* Lour. = *Ormosia pinnata* (Lour.) Merr. It would be rather strange if Loureiro, having fruiting specimens of the material he placed in *Anagyris,* would have overlooked the red seeds had either of his species actually been an *Ormosia;* he did note this red seed character for the species he described as *Cynometra pinnata.*

Prain, Jour. As. Soc. Bengal 69(2): 175. 1900 (Bot. Notes Pap. 385–396. 1901), in excluding *Macrotropis* DC. (*Anagyris* sensu Lour., non Linn.) from the synonymy of *Ormosia* Jackson, calls attention to the fact that the keel characters assigned to *Anagyris* by Loureiro are not those of *Ormosia,* a point that Miquel had already noted in accepting *Macrotropis* as the generic name for certain Malaysian species which prove to belong in *Ormosia,* for which he proposed the sectional name *Amacrotropis. Macrotropis* sensu Miquel, Fl. Ind. Bat. Suppl. 294. 1861, non DC., is a synonym of *Ormosia* Jackson.

Layia Hooker & Arnott, Bot. Beechey Voy. 182. 1833, with a single species, *Layia emarginata* Hook. & Arn., is *Ormosia* as the latter genus is currently interpreted. The generic name *Layia* Hooker & Arnott has a curious history, having been proposed informally for a genus of the Compositae and formally for a genus of the Leguminosae in the same work. The leguminous *Layia* Hooker & Arnott, which was formally published, is properly disposed of as a synonym of *Ormosia* Jackson. But its formal publication actually invalidated the synantherous genus *Layia* Hooker & Arnott, which is currently accepted by all modern authors for a group of about twenty species native of the western coast of North America. This name for the synantherous genus appears first in Hooker & Arnott, Bot. Beechey Voy. 148. 1833, in an incidental note following *Tridax ? galardioides* Hook. & Arn. thus: "If this were to form a new genus, we would propose the name *Layia,* after one of the discoverers." Five years later it was formally published by de Candolle, Prodr. 7: 294. 1838, as *Layia gaillardioides* DC. No further discussion of this case is needed, for the International Botanical Congress has formally placed the synantherous "*Laya* (minus rite *Layia*)" Hook. & Arn. in the list of *nomina generica conservanda.*

Chaenolobium Miquel, Fl. Ind. Bat. Suppl. 302. 1861, with two species from Sumatra, both based on incomplete material, was correctly reduced to *Ormosia* by Kurz. This reduction was accepted by Prain, Jour. As. Soc. Beng. 66(2): 468. 1897.

Macrotropis sensu Miquel, Fl. Ind. Bat. Suppl. 302. 1861, non DC., as noted above, is a synonym of *Ormosia* Jacks., but *Macrotropis* DC., at least for the most part, is a synonym of *Sophora* Linn.

Arillaria Kurz, Jour. As. Soc. Beng. **42**(2): 70. 1873, was based wholly on *Ormosia robusta* (Roxb.) Wight. Kurz emphasized the facts that the black seeds are arillate and that the pods are somewhat fleshy. Taubert, in Engl. & Prantl, Nat. Pflanzenfam. **3**(3): 194. 1891, retained the genus as distinct from *Ormosia*. Prain in 1900 placed it as a subgenus of *Ormosia*. It is now evident that Kurz misinterpreted the fleshy seed coats as representing an aril, and unless *Ormosia* be subdivided into a number of small genera, which does not impress us as desirable, *Arillaria* Kurz should remain as a synonym of *Ormosia*. The case is further discussed in the text, infra, p. 85.

Podopetalum F. v. Muell.[1] Melbourne Chem. Drugg. **5**: 12. 1882, Bot. Centralbl. **12**: 125. 1882, Vict. Nat. **1**: 5. 1885; Taubert in Engl. & Prantl, Nat. Pflanzenfam. **3**(3): 193. 1892; F. M. Bail. Queensl. Fl. **2**: 447. 1900; non Gaudin (1828).

Hormosia Reichenbach, Repert. Herb. Nomencl. 154. 1841, is an orthographic variant of *Ormosia*.

The references to the Chinese species are widely scattered in botanical literature. In 1887 Hemsley, Jour. Linn. Soc. Bot. **23**: 204. 1887, enumerated the three known species. In 1930 Prof. W. Y. Chun, Sci. Jour. Col. Sci. Sun Yatsen Univ. **2**: 43–48. 1930, published his "Record of the Genus *Ormosia* in Kwangtung" (in Chinese), and admitted eight species for that Province. In 1940 *Ormosia glaberrima* Wu was described from Kwangtung and Kwangsi material which we reduce to *O. emarginata* Benth. In 1920 Gagnepain, in Lecomte Fl. Gén. Indo-Chine **2**: 507–514. 1920, treated the eight known Indo-Chinese species, but, since for four of his new species he had only flowering specimens, it is difficult to place these in any scheme of classification based largely on fruit and seed characters. Unfortunately he did not indicate for any of these those vegetative characters used by Prain to differentiate the sections *Chaenolobium* and *Ormosia* proper (rachis not produced in *Chaenolobium* or produced above the insertion of the upper pair of leaflets in *Ormosia* proper), and one can, without the opportunity of consulting the type specimens, only assume that they belong in the larger group in which the leaf rachis is normally produced.

[1] **Ormosia Ormondi** (F. v. Muell.) Merrill, comb. nov.

Podopetalum Ormondi F. v. Muell. Syst. Census Austral. Pl. 42. 1882, Vict. Nat. **1**: 5. 1884; F. M. Bail. Syn. Queensl. Fl. 122. 1883, Queensl. Fl. **2**: 447. 1900.

The genus *Podopetalum* F. v. Muell. (non Gaudin, 1828) was described in 1882 on the basis of a flowering specimen, the author indicating its probable relationships with *Ormosia* and allied genera. In 1885 Mueller described the fruits and these were again described by F. M. Bailey in 1900, but neither author realized that he was dealing with an *Ormosia* as this genus was, and is, currently interpreted. Koehne, in repeating Mueller's generic diagnosis, Bot. Centralbl. **12**: 125. 1882, also includes his comments on the generic alliances; Mueller himself, in 1885, noted that the specific name did not appear until later in 1882 and then in his "Census." With excellent fruiting material from Queensland, the type region, I find no reason for considering that *Podopetalum* F. v. Muell. (non Gaudin, 1828) is other than *Ormosia* as the latter genus is generally interpreted and accordingly reduce it to the synonymy of the latter genus and transfer its type species to *Ormosia*. Taubert, in Engl. & Prantl, Nat. Pflanzenfam. **3**(3): 193. 1892, in accepting *Podopetalum* F. v. Muell. as a valid genus, makes the curious error of crediting it to New Zealand; as far as our records go it is known only from Queensland. This extends the generic range of *Ormosia* in the Old World to Queensland, Australia, where the species occurs along river banks, removes *Podopetalum* F. v. Muell. from the list of Australian genera and adds *Ormosia* in its place. Mueller's species is allied to *Ormosia calavensis* Azaola. E. D. M.

For neighboring regions in Asia, Baker, in Hook. f. Fl. Brit. Ind. **2**: 252–254. 1878, considered seven species from British India, including those of British Burma and the Malay Peninsula (three in British India, one in Burma and four in the Malay Peninsula). There are now six species known from Burma, and the number of Malay Peninsula species was increased to eight by Prain, Jour. As. Soc. Bengal **66**(2): 146–152. 1897 (Mater. Fl. Malay. Penin. **3**: 146–152); to these Ridley added a ninth, Fl. Malay Penin. **1**: 612–615. 1922. Only two species are recorded from Thailand (Siam), Craib, Fl. Siam. Enum. **1**: 497. 1928, one of which extends to Yunnan. A single species occurs in Formosa. In the Malay Archipelago, including the Philippines, the genus is not strongly represented. Including the actually described species and certain apparently as yet undescribed ones, at least six occur in Sumatra, two in Java, three in Borneo, seven in the Philippines (of which *Ormosia calavensis* Azaola extends to the Moluccas, New Guinea, and the Palao Islands), and two in Celebes. It is highly probable that the number of Malaysian species will be increased as exploration progresses, for here, as is apparently the case in other parts of its generic range in the Old World, many of the species appear to be rare and local. A single species occurs in Australia. The few native African species formerly considered to belong in *Ormosia* are now placed in *Afrormosia* Harms and *Haplormosia* Harms.

Continental Asia (including the Malay Peninsula) seems clearly to be the center of distribution of the genus in the Old World, with no less than forty-seven species now known from various parts of the continent, and China has more known species (twenty-seven) than any other political area within the generic limits of the group in both hemispheres.

For convenience we have compiled the following list of Old World species, giving the known synonymy of each, except for those considered in detail in the body of this paper, and the geographic range of each species as far as this is known.

A List of the Old World Species of Ormosia[1]

1. **Ormosia apiculata** Chen, infra p. 111.
   China (Kwangsi).

[1] Several species have been described from Africa, but all of the native ones actually belong in the genera *Afrormosia* Harms and *Haplormosia* Harms. One species was described from specimens taken from an introduced and cultivated tree in the experimental garden at Victoria, Cameroons, and should be eliminated from the African list. This is *Ormosia Zahnii* Harms, Repert. Sp. Nov. **19**: 290. 1924, based on *Zahn 336, 688,* and regarding it Harms states: "Die Art stammt vielleicht aus dem tropischen Amerika, und es könnte sein, das sie von P. Preuss eingeführt worden est. Ich konnte sie zu keiner der mir bekannten Arten bringen und habe sie dahir als Neuheit beschrieben." The remaining African species are as follows:

Ormosia angolensis Baker in Oliver, Fl. Trop. Afr. **2**: 255. 1871 = **Afrormosia angolensis** (Baker) Harms in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. **3**: 158. 1906. Lower Guinea.

Ormosia Brasseuriana de Wild. Ann. Mus. Congo Bot. **1**: 183. 1903 (Étud. Fl. Katanga) = **Afrormosia Brasseuriana** (de Wild.) Harms in Engl. Pflanzenw. Afr. **3**(1): 527. 1915, *in obs.* Belgian Congo.

Ormosia laxiflora Benth. ex Baker in Oliver, Fl. Trop. Afr. **2**: 255. 1871 = **Afrormosia laxiflora** (Benth.) Harms in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. **3**: 158. 1906. Upper Guinea.

Ormosia monophylla Harms ex Stapf in Johnston, Liberia **2**: 598. 1906 = *Crudia arborea* Harms, Bot. Jahrb. **30**: 80. 1901 = **Haplormosia monophylla** Harms, in Engl. Pflanzenw. Afr. **3**(1): 533. 1915. Liberia.

2. **Ormosia Balansae** Drake, Jour. de Bot. **5**: 215. 1891; infra p. 114 (*O. elliptilimba* Merr. & Chun).
   Indo-China (Tonkin), China (Hainan, Kwangsi).
3. **Ormosia bancana** (Miq.) Prain, Jour. As. Soc. Bengal **69**(2): 184. 1900 (Bot. Notes Pap. 394. 1901), *in nota*.
   Macrotropis ? bancana Miq. Fl. Ind. Bat. Suppl. 295. 1861.
   Ormosia parvifolia Baker in Hook. f. Fl. Brit. Ind. **2**: 253. 1878; Prain ex King, Jour. As. Soc. Bengal **66**(2): 149 (Mater. Fl. Malay. Penin. **3**: 149), 469. 1897, **69**(2): 184. 1900 (Bot. Notes Pap. 394. 1901); Ridl. Fl. Malay Penin. **1**: 614. 1922.
   Malay Peninsula, Sumatra, Banca, Borneo.
4. **Ormosia basilanensis** Merr. Philip. Jour. Sci. **14**: 407. 1919, Enum. Philip. Fl. Pl. **2**: 269. 1923.
   Philippines (Basilan).
5. **Ormosia calavensis** Azaola in Blanco, Fl. Filip. ed. 2, 230. 1845; Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901); Merr. Philip. Jour. Sci. **1**: Suppl. 64. 1906, Philip. Jour. Sci. Bot. **5**: 58. 1910, Interpret. Rumph. Herb. Amb. 262. 1817, Enum. Philip. Fl. Pl. **2**: 269. 1923; Kaneh. Bot. Mag. Tokyo **45**: 285. 1931, Fl. Micronesica 144. *f. 49*. 1933.
   Pongamia ? corollaria Miq. Fl. Ind. Bat. **1**(1): 149. 1855.
   Corollaria latifolia Rumph. Herb. Amb. **3**: 175. *t. 110*. 1743.
   Philippines (Luzon to Mindanao), Moluccas, New Guinea, Palao Islands.
6. **Ormosia cambodiana** Gagnep. Not. Syst. **3**: 29. 1914, infra p. 102.
   Indo-China (Cambodia).
7. **Ormosia cathayensis** Chen, infra p. 112.
   China (Kwangtung).
8. **Ormosia Clementis** Merr. Philip. Jour. Sci. **14**: 406. 1919, Enum. Philip. Fl. Pl. **2**: 270. 1923.
   Philippines (Mindanao).
9. **Ormosia crassivalvis** Gagnep. Not. Syst. **3**: 29. 1914, infra p. 101.
   Indo-China (Cochinchina).
10. **Ormosia decemjuga** (Miq.) Prain, Jour. As. Soc. Bengal **66**(2): 468. 1897, **69**(2): 184. 1900 (Bot. Notes Pap. 394. 1901).
    Chaenolobium decemjugum Miq. Fl. Ind. Bat. Suppl. 302. 1861.
    Sumatra.
11. **Ormosia emarginata** (Hook. & Arn.) Benth. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 77. 1852 (*Layia emarginata* Hook. & Arn.), infra p. 107.
    Ormosia glaberrima Wu, Bot. Jahrb. **71**: 182. 1940.
    Indo-China (Tonkin), China (Hongkong, Kwangtung, Kwangsi, Hainan).
12. **Ormosia euphorioides** Pierre, ex Gagnep. Not. Syst. **3**: 30. 1914, infra p. 114.
    Indo-China (Cochinchina).
13. **Ormosia Fordiana** Oliv. in Hook. Ic. **25**: *t. 2422*. 1896; infra p. 101.
    Indo-China (Tonkin), China (Kwangtung, Hainan, Kwangsi, Yunnan).
14. **Ormosia formosana** Kaneh. Bot. Mag. Tokyo **30**: 420. 1916, infra p. 109.
    Formosa.
15. **Ormosia glauca** Wall. Pl. As. Rar. **2**: 23. *t. 125*. 1831; Baker in Hook. f. Fl. Brit. Ind. **2**: 253. 1878; Prain, Jour. As. Soc. Bengal **66**(2): 467. 1897, **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901).
    India.
16. **Ormosia gracilis** Prain ex King, Jour. As. Soc. Bengal **66**(2): 148 (Mater. Fl. Malay. Penin. **3**: 148), 468. 1897, **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901); Ridl. Fl. Malay Penin. **1**: 613. 1922.
    Malay Peninsula.
17. **Ormosia grandifolia** Merr. Philip. Jour. Sci. **14**: 408. 1919, Enum. Philip. Fl. Pl. **2**: 270. 1923.
    Philippines (Luzon).
18. **Ormosia Henryi** Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901), infra p. 109 (*O. Henryi* Hemsl. & Wils., *O. mollis* Dunn & Tutch.).
    Indo-China (Tonkin), China (Chekiang, Fukien, Anhwei, Kwangsi, Hupeh, Kiangsi, Hunan, Kweichow, Kwangtung).
19. **Ormosia hoaensis** Pierre ex Gagnep. Not. Syst. **3**: 32. 1914; infra p. 114.
    Indo-China (Cochinchina).

20. **Ormosia Hosiei** Hemsl. & Wils. Kew Bull. **1906**: 156. 1906 (*O. Taiana* Chiao), infra p. 113.
China (Hupeh, Szechuan, Shensi, Kiangsu).
21. **Ormosia Howii** Merr. & Chun, infra p. 112.
China (Hainan).
22. **Ormosia incerta** Koord. in Koord. & Val. Atlas Baumart. Java **4**: *t. 798*. 1918.
Java.
23. **Ormosia indurata** Chen, infra p. 104.
China (Kwangtung, Kwangsi).
24. **Ormosia inflata** Merr. & Chun, infra p. 100.
China (Hainan).
25. **Ormosia inopinata** Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901) (var. **typica** Prain, l.c.).
Burma (Kachin Hills).
Var. **dubia** Prain, l.c. (*Ormosia dubia* Prain, op. cit. 182, *in nota*).
Burma (Kachin Hills).
26. **Ormosia kwangsiensis** Chen, infra p. 108.
China (Kwangsi).
27. **Ormosia laxa** Prain, Jour. As. Soc. Bengal **69**(2): 182. 1900 (Bot. Notes Pap. 392. 1901).
Burma (Kachin Hills).
28. **Ormosia longipes** Chen, infra p. 100.
China (Yunnan).
29. **Ormosia macrodisca** Baker in Hook. f. Fl. Brit. Ind. **2**: 253. 1878; Prain ex King, Jour. As. Soc. Bengal **66**(2): 148 (Mater. Fl. Malay. Penin. **3**: 148), 467. 1897, **69**(2): 179. 1900 (Bot. Notes Pap. 389. 1901); Ridl. Fl. Malay Penin. **1**: 613. 1922.
Malay Peninsula, Sumatra.
30. **Ormosia Merrilliana** Chen, infra p. 99.
Indo-China (Tonkin), China (Kwangtung, Kwangsi).
31. **Ormosia microphylla** Merr., infra p. 109.
China (Kwangsi).
32. **Ormosia microsperma** Baker in Hook. f. Fl. Brit. Ind. **2**: 253. 1878; Prain ex King, Jour. As. Soc. Bengal **66**(2): 151 (Mater. Fl. Malay. Penin. **3**: 151), 468. 1897, **69**(2): 183. 1900 (Bot. Notes Pap. 393. 1901); Ridl. Fl. Malay Penin. **1**: 614. 1922.
Ormosia coarctata sensu Kurz, Jour. As. Soc. Bengal **42**(2): 71. 1873, non Jacks.
Malay Peninsula.
Var. **Ridleyi** Prain, Jour. As. Soc. Bengal **66**(2): 151 (Mater. Fl. Malay. Penin. **3**: 151), 468. 1897, **69**(2): 183. 1900 (Bot. Notes Pap. 393. 1901); Ridl. Fl. Malay Penin. **1**: 615. 1922 (*Ormosia Ridleyi* Prain, l.c., *in nota*).
Singapore.
33. **Ormosia monochyana** Boerl. & Koord. ex Koord. Meded.'s Lands Plantent. **19**: 441. 1898.
Celebes.
34. **Ormosia nanningensis** Chen, infra p. 113.
China (Kwangsi).
35. **Ormosia olivacea** Chen, infra p. 110.
China (Yunnan).
36. **Ormosia orbiculata** Merr. Philip. Jour. Sci. **14**: 405. 1919, Enum. Philip. Fl. Pl. **2**: 270. 1923.
Philippines (Luzon).
37. **Ormosia Ormondi** (F. Muell.) Merr. supra, p. 79.
Podopetalum Ormondi F. Muell. Syst. Census Austral. Pl. 42. 1882, Vict. Nat. **1**: 5. 1884; F. M. Bail. Queensl. Fl. **2**: 447. 1900.
Australia (Queensland).
38. **Ormosia pachycarpa** Champ. ex Benth. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 76. 1852; infra p. 98.
China (Hongkong).
39. **Ormosia pachyptera** Chen, infra p. 104.
China (Kwangsi).

40. **Ormosia palembanica** S. Moore, Jour. Bot. **64**: Suppl. 145. 1926.
Sumatra.
41. **Ormosia paniculata** Merr. Govt. Lab. [Philip. Publ.] **35**: 21. 1905, Philip. Jour. Sci. **1**: Suppl. 64. 1906, Philip. Jour. Sci. Bot. **5**: 58. 1910, Enum. Philip. Fl. Pl. **2**: 270. 1923.
Philippines (Luzon).
42. **Ormosia penangensis** Ridl. Jour. As. Soc. Straits Branch **68**: 11. 1915, Fl. Malay Penin. **1**: 613. 1922.
Malay Peninsula (Penang).
43. **Ormosia pinnata** (Lour.) Merr. Lingnan Sci. Jour. **14**: 12. 1935, infra p. 103 (*Cynometra pinnata* Lour., *Ormosia hainanensis* Gagnep.).
Indo-China (Annam), China (Kwangtung, Hainan).
44. **Ormosia polita** Prain, Jour. As. Soc. Bengal **69**(2): 184. 1900 (Bot. Notes Pap. 394. 1901).
Ormosia nitida Prain ex King, op. cit. **66**(2): 149 (Mater. Fl. Malay. Penin. **3**: 149), 468. 1897; Ridl. Fl. Malay Penin. **1**: 613. 1922; non Vogel.
Malay Peninsula.
45. **Ormosia polysperma** Chen, infra p. 106.
China (Kwangtung, Kwangsi, Kiangsi).
46. **Ormosia purpureiflora** Chen, infra p. 105.
China (Kwangtung).
47. **Ormosia robusta** (Roxb.) Wight ex Baker in Hook. f. Fl. Brit. Ind. **2**: 252. 1878; Prain, Jour. As. Soc. Bengal **69**(2): 179. 1900 (Bot. Notes Pap. 389. 1901), **73**(2): 45. 1904; Craib, Fl. Siam. Enum. **1**: 497. 1928; Kanjilal, Kanjilal & Das, Fl. Assam **2**: 118. 1938.
Sophora robusta Roxb. Hort. Beng. 31. 1814, *nomen nudum;* Wight, Ic. **1**: [25]. *t. 245.* 1840.
Ormosia floribunda Wall. List no. 5337. 1832, *nomen nudum.*
Arillaria robusta Kurz, Jour. As. Soc. Bengal **42**(2): 71. 1873, For. Fl. Brit. Burma **1**: 334. 1877; Taub. in Engl. Nat. Pflanzenfam. **3**(3): 194. 1892.
India, Burma, Siam.
48. **Ormosia scandens** Prain ex King, Jour. As. Soc. Bengal **66**(2): 147 (Mater. Fl. Malay. Penin. **3**: 147), 467. 1897, **69**(2): 182. 1900 (Bot. Notes Pap. 392. 1901); Ridl. Fl. Malay Penin. **1**: 612. 1922.
Malay Peninsula.
49. **Ormosia semicastrata** Hance, Jour. Bot. **20**: 78. 1882, infra p. 111.
China (Kwangtung, Hainan, Kwangsi).
50. **Ormosia septemjuga** (Miq.) Prain, Jour. As. Soc. Bengal **66**(2): 468. 1897, **69**(2): 184. 1900 (Bot. Notes Pap. 394. 1901).
Chaenolobium septemjugum Miq. Fl. Ind. Bat. Suppl. 302. 1861.
Sumatra.

A species of somewhat doubtful status, based on sterile material, allied to *Ormosia microsperma* Baker, to which Kurz reduced Miquel's species; Prain thinks that it is not the same as Baker's species.

51. **Ormosia sericeolucida** Chen, infra p. 107.
China (Kwangsi).
52. **Ormosia simplicifolia** Merrill & Chun, infra p. 102.
Ormosia obscurinervia Merr. & Chun ex Tanaka & Odashima, Jour. Soc. Trop. Agr. **10**: 369. 1938, *nomen nudum.*
Indo-China (Tonkin), China (Hainan).
53. **Ormosia striata** Dunn, Jour. Linn. Soc. Bot. **35**: 492. 1903, infra p. 103.
China (Yunnan), Burma.
54. **Ormosia sumatrana** (Miq.) Prain ex King, Jour. As. Soc. Bengal **66**(2): 150 (Mater. Fl. Malay. Penin. **3**: 150), 469. 1897, **69**(2): 183. 1900 (Bot. Notes Pap. 393. 1901); Ridl. Fl. Malay Penin. **1**: 614. 1922; Koord. Exkursionsfl. Java **2**: 372. 1912, **4**(Atlas): *f. 1215.* 1926.
Macrotropis sumatrana Miq. Fl. Ind. Bat. Suppl. 294. 1861.
Malay Peninsula, Sumatra, Java.

55. **Ormosia surigaensis** Merr. Philip. Jour. Sci. **17**: 263. 1920, Enum. Philip. Fl. Pl. **2**: 270. 1923.
Philippines (Mindanao).
56. **Ormosia tavoyana** Prain, Jour. As. Soc. Bengal **73**(2): 46. 1904.
Burma.
57. **Ormosia tonkinensis** Gagnep. Not. Syst. **3**: 200. 1914, infra p. 115.
Indo-China (Tonkin).
58. **Ormosia travancorica** Bedd. Fl. Sylv. S. Ind. *t. 45.* 1869; Baker in Hook. f. Fl. Brit. Ind. **2**: 253. 1879; Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901).
India.
59. **Ormosia Tsangii** Chen, infra p. 115.
Indo-China (Tonkin).
60. **Ormosia venosa** Baker in Hook. f. Fl. Brit. Ind. **2**: 254. 1878; Prain ex King, Jour. As. Soc. Bengal **66**(2): 152 (Mater. Fl. Malay. Penin. **3**: 152). 1897, **69**(2): 185. 1900 (Bot. Notes Pap. 395. 1901); Ridl. Fl. Malay Penin. **1**: 615. 1922.
Malay Peninsula.
61. **Ormosia Villamilii** Merr. Philip. Jour. Sci. Bot. **10**: 313. 1915, Enum. Philip. Fl. Pl. **2**: 270. 1923.
Philippines (Mindanao).
62. **Ormosia Watsonii** C. E. C. Fischer, Kew Bull. **1927**: 88. 1927.
Burma.
63. **Ormosia xylocarpa** Chun, infra p. 105.
China (Hainan, Kwangsi).
64. **Ormosia yunnanensis** Prain, Jour. As. Soc. Bengal **69**(2): 183. 1900 (Bot. Notes Pap. 393. 1901), infra p. 110.
China (Yunnan), Siam.

The genus as a whole has been variously divided. Bentham, in Martius Fl. Brasil. **15**(1): 315–319. 1862, placed the nine then known Brazilian species in two groups, *Concolores*, with leaflets glabrous or nearly so on both surfaces, and *Discolores*, with leaflets paler beneath and puberulous, silky, or tomentose. While he named and characterized the groups, he did not assign any definite category to them such as subgenus, section, or subsection. Baker, in Hook. f. Fl. Brit. Ind. **2**: 252–254. 1878, adopted the same arrangement for the Indian species, but assigned no names to the subdivisions. Taubert, in Engl. & Prantl, Nat. Pflanzenfam. **3**(3): 194. 1892, formally accepted Bentham's groups as sections applicable to the whole genus. Prain, Jour. As. Soc. Bengal **69**(2): 175–186. 1900 (Bot. Notes Pap. 385–396. 1901), did not accept Taubert's sectional names, as he thought that this did not always permit species that are manifestly closely related to remain together. He considered that a classification based on characters derived from the fruits and seeds was preferable to one based on the color and degree of tomentum of the leaves, and we can but agree with him in this matter.

Prain arranged the Old World species in two subgenera, *Arillaria* (Kurz) Prain, and *Toulichiba* (Adanson) Prain, the former containing a single species, *Ormosia robusta* (Roxb.) Wight, which is described as having somewhat fleshy pods, the large black seeds enclosed in a fleshy red aril. *Toulichiba* was characterized by having woody or at least very coriaceous pods and non-arillate seeds, and under this Prain arranged the Old World species, as far as possible on the basis of the material available to him, under the sections *Chaenolobium* (Miq.) Prain, and *Ormosia* proper, the latter with three subsections, *Macrodisca* Prain, *Layia* (Hook. & Arn.) Prain, and *Amacrotropis* Miq., these subdivisions being based on the characters of the fruits and the seeds. Four years later, Jour. As. Soc. Bengal **73**(2): 46. 1904, Prain proposed a fourth subsection, *Striatae*,

to take *Ormosia striata* Dunn. We have seen no eastern Asiatic species that we consider to be referable to the subsection *Macrodisca* Prain.

While Prain's scheme of classification has its favorable aspects, there is some question regarding his divisions. He proposed two subgenera, *Arillaria* (Kurz) Prain (*Arillaria* Kurz as a genus) with "pod with fleshy valves; seeds black, enveloped in a fleshy arillus," and *Toulichiba* (Adanson) Prain (*Toulichiba* Adanson as a genus) with "pod with woody valves; seeds scarlet, with or without a black spot near the hilum, not enveloped in an aril." The former was based on an Asiatic species, *Ormosia robusta* (Roxb.) Wight. Unfortunately the material available to us representing Wight's species has very immature pods and seeds, but from an examination of this we conclude that *Arillaria* was proposed, and has been maintained, on the basis of a misinterpretation of the seed characters. In proposing the genus *Arillaria*, Kurz described the seeds of *A. robusta* (Roxb.) Kurz thus: "Semina 2 v. abortu ut plurimum solitarium, magna, oblonga, nigra, arillo carnoso miniato complete involutum" and as "semen magnum, oblongum, aterrimum, lucidum, arillo miniato dein sanguineo carnoso complete involutum." Baker added the size of the seeds as one and one-half inches in length, quoting from Kurz, "enveloped in a complete thick scarlet aril." Kurz's interpretation was accepted by Taubert and by Prain. Our *Shaik Mokim* specimen from Tavoy, determined by Prain as representing *Ormosia robusta* (Roxb.) Wight, has immature pods and seeds, as noted above, but a careful examination of these shows that the cotyledons are free within a somewhat thickened aril-like integument, which on soaking becomes distinctly fleshy, and which we interpret not as an aril, but as the free and fleshy seed coats.[1] We call attention to the fact that in the seeds of the otherwise totally different *Ormosia Fordiana* Oliv. a similar development occurs, in that when the seeds are mature they are, when dry, surrounded by uniformly red, free or nearly free, crustaceous and fragile seed coats, and that these, when fresh, are more or less fleshy and actually stain the adjacent inner walls of the valves more or less red; these seed coats of *Ormosia Fordiana* Oliv. simulate the aril. However, in a further discussion of the so-called "aril" of certain species of *Ormosia*, it should be noted that for *Ormosia gracilis* Prain the seeds are described as "usually solitary, oblong, .75 in. long, with a black adnate smooth aril." Of this we have seen but a single specimen, *Md. Nur 11747*, from Negri Sembilan, determined at Singapore as representing *Ormosia gracilis* Prain, and in this the mature seed is suborbicular in outline, about 2 cm. in diameter, hard, somewhat rugose, shining and brownish red in color, with no sign of an aril. Of course this specimen may be wrongly identified, but as far as one can tell from the published descriptions it agrees very closely except that there is no aril. Re-

[1] Mr. Sealy of the Royal Botanic Gardens, Kew, examined the material in the Kew Herbarium, and reports under date of February 10, 1942, as follows: "Our only specimen of *Ormosia robusta* (Roxb.) Wight (*Arillaria robusta* Kurz) with fruits is *Kurz 1737*, and unfortunately there are no good seeds. One fruit still has a seed but the inside of this is quite eaten away, and the crustaceous coat is crushed. The seed coat is rusty coloured and a section of a small piece of it showed a thin reddish epidermal layer over a thick one, which in some sections was more or less homogeneous and brownish, but which in other sections appeared as two zones of contrasting colour, the upper reddish to very dark brown, the lower brownish. I should say that the reddish 'skin' represented an integument and not an aril." In June, 1942, Dr. Hochreutiner of Geneva sent us a mature seed of *Shaik Mokim 716* from Burma and states that there is no aril. An examination of this seed confirms his statement, in that the integuments, apparently somewhat fleshy when fresh, are thickened when dry, free from the cotyledons, red, and distinctly rugose.

garding the material representing *O. gracilis* Prain in the Kew Herbarium, Mr. Sealy states: "The black basal part of the outer seed coat is scarcely thickened. I did not care to dissect the only seed on *Wray 2979,* but I have boiled up and cut a seed from *Ridley 2103,* which is exactly similar. The black and red parts form one continuous coat beyond a shadow of doubt." The species is thus non-arillate.

Baker described the seeds of *Ormosia macrodisca* Baker as having "a large black pitted aril" and Prain used this character in his key for separating this species and *Ormosia gracilis* Prain from other species of the genus. Unfortunately our single specimen of *Ormosia macrodisca* Bak., *Maingay 600,* is incomplete; the valves are present but the seeds are lacking. Mr. Sealy kindly examined the Kew specimen of *Maingay 600* and reports that the black basal parts of the seed coats are slightly thickened, and that in section the seed coat and so-called "aril" appear as one continuous coat, very similar to the condition noted in the seeds of *Ormosia gracilis* Prain. It is thus clear that the so-called "aril" must be eliminated from the description of both *O. macrodisca* Baker and *O. gracilis* Prain.

Ormosia Taiana Chiao = *O. Hosiei* Hemsl. & Wils. was erroneously described as having red-arillate seeds; examination of an isotype shows that the hard smooth red testa was inadvertently described as an aril.

As to the subgeneric name *Toulichiba* (Adanson) Prain (*Toulichiba* Adanson as a genus), this was originally based wholly on "Pseudo-Acacia Plum. M. S. Vol. 7. *t. 145,*" and Jackson actually examined Plumier's unpublished plate. The same Plumier plate was cited by Aublet, Hist. Pl. Guiane **2**: 773. 1775, as representing *Robinia coccinea* Aubl. It is the West Indian *Ormosia monosperma* (Sw.) Urban, Symb. Antil. **1**: 321. 1899, *in obs.,* Rep. Sp. Nov. Beih. **5**: 147. 1920, of which *O. dasycarpa* Jacks. is a synonym. Thus, as *Toulichiba* nomenclaturally is an exact synonym of Ducke's § *Bicolores, Vulgares,* it should not, we feel convinced, be used for an Asiatic-Malaysian assemblage that does not conform entirely with the characters of the original American group. As a major or minor group, *Toulichiba* nomenclaturally is not only exactly *Ormosia* as originally defined by Jackson, but it is also identical with Prain's subdivision *Ormosia* proper.

Ducke, Arch. Jard. Bot. Rio Janeiro **3**: 135–139. 1922, **4**: 61–71. 1925, arranged the Brazilian species in three sections, *Macrocarpae, Flavae,* and *Bicolores.* Amshoff, Meded. Bot. Mus. Herb. Rijks Univ. Utrecht **52**: 47. 1939, proposed a new section *Unicolores,* which Ducke, in the same year, Ann. Acad. Bras. Scienc. **21**: 179–193. *2. t.* 1939, in his last revision of the twenty Brazilian species, placed as a subsection of *Bicolores.* Ducke's final arrangement includes § *Macrocarpae* and § *Flavae,* each with one species and both in part characterized by having indehiscent pods; the Old World species, with the possible exception of *Ormosia Balansae* Drake, have dehiscent pods, for those of Drake's species appear to be indehiscent or very tardily dehiscent. *Ormosia Coutinhoi* Ducke of Brazil, the only species in the section *Macrocarpae,* and *O. Balansae* Drake of southern China and Tonkin have one very striking character in common, that being a very greatly elongated hilum; otherwise the two are not closely allied. Ducke's third section, *Bicolores,* characterized by having dehiscent pods, the seeds more or less compressed and red with a black spot, or wholly red, the ovaries pubescent, probably is closer to the Old World representatives of the genus than are the other two sections. This group he subdivided into three

subsections: *Subglobosae,* the seeds globose, large, 2.5 cm. in diameter, with transverse cotyledons, to take one species; *Unicolores,* with strongly compressed, uniformly red shining seeds, the cotyledons longitudinal, with four species; and *Vulgares,* with moderately compressed seeds varying in size up to a maximum of 15 mm. in length, with transverse cotyledons, the testa red and usually with a black spot, the presence or absence of this black spot not always uniform in certain species; to this last group belong many of the American species.

It is probable that the affiliations of the majority of the Old World species are to be sought in Ducke's section *Bicolores,* subsections *Unicolores* and *Vulgares,* the latter being both *Ormosia* Jacks. as originally described, and *Toulichiba* Adans. Amshoff stated that she did not know whether Prain's section *Ormosia* proper was quite identical with the section *Bicolores* Ducke, to which the type species of *Ormosia* belongs. We judge that the Old World species probably should not be placed in the same divisions and subdivisions that Ducke established for the Brazilian forms. Ducke did not discuss Prain's scheme of classification, probably because he did not have access to the latter's paper.

In most of the Old World species the seeds are uniformly red, the testa being hard, smooth, and shining; when the seeds are immature, the red color may approximate orange-red. We have seen no Old World species with yellow seeds. One Indo-Chinese species, *Ormosia crassivalvis* Gagnep., has seeds 3 cm. long, the testa hard, smooth, shining and uniformly black or black more or less mottled with brownish red, the margins always surrounded by a very distinct red band 2 to 5 mm. wide. A single Philippine species, *Ormosia Clementis* Merr., has red seeds with a black spot near the hilum as in many American species; the "black aril," which Baker credited to the seeds of *Ormosia macrodisca* Baker and which Prain credited to *Ormosia gracilis* Prain, proves to be a black part of the seed integuments and not an aril at all. As opposed to the numerous species with red hard seeds, there are a few centering around *Ormosia pachycarpa* Champ. that have black or almost black, uniformly castaneous or pale brown seed coats, these more or less crustaceous, sometimes fragile, and easily separable from the cotyledons. Another type is represented by *Ormosia Fordiana* Oliv., where, at maturity, the red seed coats are more or less fleshy when fresh, actually staining the inner walls of the pods opposite the seeds, but when dry become crustaceous, fragile, and free or nearly free from the cotyledons, simulating an aril. It is clear that the so-called aril in *Ormosia robusta* (Roxb.) Wight, which lead Kurz to propose the genus *Arillaria* for this form, is nonexistent, and what was mistaken for an aril is actually the thickened fleshy seed coats.

In the majority of the Old World species the seeds are more or less elongated and horizontal in the pod. They vary greatly in size from less than 1 cm. in length to as much as 3 cm., or in *Ormosia robusta* (Roxb.) Kurz to as much as 4 cm. long. In most species they are more or less compressed, although they are never very flat, but in some they are almost globose. In others they may be somewhat wider than long, approaching orbicular or very broadly orbicular-obovate in outline, but never reniform.

In a few Old World species, such as *Ormosia simplicifolia* Merr. & Chun and *O. xylocarpa* Chun, quite unrelated in other characters, the mature seeds, although with hard smooth red and shining integuments like the majority of the Asiatic-Malaysian species, may be distinctly viscid, at least when fully mature, but this character is apparently of little significance.

The hilum character has received little attention. An examination of all of our material shows that, as far as the seeds are known, the hilum is usually small, 1 to 3 or occasionally 3.5 mm. long. In two species, however, it is distinctly elongated. Thus in the seeds of *Ormosia Hosiei* Hemsl. & Wils. (*O. Taiana* Chiao) the conspicuous hilum is 7 mm. in length and in the otherwise quite unrelated *Ormosia Balansae* Drake the very conspicuous hilum extends nearly half way around the seed, attaining a length of 15 mm. In all other characters these two species conform to the majority of the species of *Ormosia* and there seems to be no valid reason for subdividing the genus on this character alone. One Brazilian species (*Ormosia Coutinhoi* Ducke), has a very long hilum, and Pierce, Trop. Woods 71: 1–2. 1942, has removed it from *Ormosia*, establishing for it the new genus *Macroule* Pierce.

The pods present great variations in size, in shape, in the number of seeds, in indumentum, and in the characters of the valves, but in most of the Old World species they are ultimately dehiscent. The valves vary in texture from crustaceo-coriaceous to very woody, and from less than 1 mm. to several mm. in thickness. The pods may be small or large, glabrous or pubescent, strongly compressed or almost cylindric, and while in certain species they are always one-seeded, in others the number of seeds varies from one to as many as nine or ten, and pods with such variations not infrequently occur on the same specimen. In some species the pods are non-septate between the seeds, or with only vestiges of septae, while in others they are always septate. In certain species the valves are distinctly depressed between the seeds, becoming at least subtorulose, but in others they are smooth and without depressions. In at least one Chinese species the greatly thickened edges of the valves are produced as a wing-like margin extending 5 to 15 mm. beyond the seed-bearing parts of the pod. In certain species, notably *Ormosia simplicifolia* Merr. & Chun, *O. striata* Dunn, *O. pinnata* (Lour.) Merr., *O. indurata* Chen, *O. xylocarpa* Chun, *O. polysperma* Chen, *O. emarginata* (Hook. & Arn.) Benth., *O. Henryi* Prain, and *O. yunnanensis* Prain, the pods, even on a single specimen, vary greatly in the number of developed seeds, in shape, and in size, the number of seeds in a few species varying from one to as many as nine or ten, although the variation is mostly much less, from one to four or five; in these cases there is a corresponding variation in the size and shape of the pods.

Except in size, indumentum, color, and the outlines of petals, etc., the floral characters are in general distinctly uniform. The standard may or may not be provided with basal indurated areas, and the keel and wing petals may or may not be auriculate at their bases; all petals are, in general, glabrous. The ovaries may be sessile or distinctly stipitate, and glabrous, uniformly densely pubescent, or glabrous on the sides and pubescent on their margins; the ovules vary from two or three to as many as ten. In most species there are ten free stamens, but in one group, characterized by *Ormosia semicastrata* Hance, there are only five fertile stamens, but even here, a point that Hance did not mention, the flowers of his type collection have very slender staminodes or sterile filaments, these varying in number from two to four; in this group the pods are always small and strictly 1-seeded, but the small seeds are those of *Ormosia*, being hard, red, smooth, and shining.

In habit, with one exception, all of the Old World species are erect shrubs or trees. *Ormosia scandens* Prain, of the Malay Peninsula, is a large vine, but of this the fruits are as yet unknown. Some of the species are glabrous through-

out, while other are very pubescent, the type, color, and characters of the indumentum varying greatly.

In vegetative characters, all of the Old World species have pinnate leaves with the exception of *Ormosia simplicifolia* Merr. & Chun, in which all the leaves are strictly simple. The leaflets vary greatly in number, size, shape, texture, and indumentum, occasionally 3-foliolate leaves being noted; but not infrequently on the same specimen one notes considerable variation in the number of pairs of leaflets; normally the leaves are imparipinnate. The rachis character that Prain depended upon to characterize his section *Chaenolobium* proves to be inconstant. In a few species we have noted no prolongation of the rachis above the insertion of the upper pair of leaflets, but in other species, notably *Ormosia pachycarpa* Champ., placed by Prain in *Chaenolobium*, the rachis may be not at all produced or shortly but distinctly produced even on the same specimen. Among those species that Prain would place in *Ormosia* proper, characterized in part by the rachis being distinctly produced, we note five or six species where the rachis production, normally well developed, may be entirely absent, or produced and non-produced rachises occurring on the same specimen. In such a characteristic species as *Ormosia semicastrata* Hance, where in the Hongkong type the rachis is very greatly produced, most of the specimens from China proper that we place here have the rachises much less produced, often only slightly so. We conclude that this rachis character, being distinctly variable, is scarcely a sufficiently strong one to be used for other than the differentiation of species, and even here it must be used with caution.

In 1900, Prain, Jour. As. Soc. Bengal **69**(*2*): 175–186. 1900 (Bot. Notes Pap. 385–396. 1901), in his summary of the data then available regarding the Asiatic (and Malaysian) species of *Ormosia*, recognized twenty-two species. He states: "As regards the distribution the most striking features connected with *Ormosia* are (1) the widespread occurrence of the genus throughout Southeastern Asia, from Hupeh in China to Bangka in the Malayan Archipelago, and from Travancore and Nepal to the Philippines; (2) the remarkably limited range of individual species with the exception of *O. parvifolia* [= *O. bancana*] which extends from the Malay Peninsula to Bangka and Borneo, and to a less extent *O. sumatrana* which occurs on both sides of the Straits of Malacca. *O. robusta* also has a wider range than most of the species for it extends from the valley of Assam through Silhet and Chittagong to Pegu and Tenasserim. It is interesting, however, to note that very closely related species such as *O. pachycarpa* and *O. venosa*, and again *O. yunnanensis* [now also known from Siam] and *O. sumatrana*, may occur in widely separated localities." The picture is now considerably changed, as the limits of the genus have been extended farther north in China, and east to Formosa, and farther to the south and east, with representatives now known from Java, Celebes, the Moluccas, New Guinea, the Palao Islands, and Australia (Queensland).

The present study of the eastern Asiatic species of *Ormosia* confirms Prain's findings. It is a notable fact that of the thirty-four species now known from China, Formosa, and Indo-China, twenty are known only from single provinces. The geographic ranges of the other species within the area considered are all restricted to contiguous or relatively close geographic units (provinces), except *Ormosia Henryi* Prain, which is now known from Chekiang, Anhwei, Fukien, Kwangtung, Kwangsi, Kweichow, Kiangsi, Hupeh, Hunan, and Tonkin. The known distribution of the remaining species occurring in more than one geo-

graphic subdivision are: *Ormosia Balansae* Drake (Tonkin, Hainan, Kwangsi), *O. emarginata* Benth. (Kwangtung, Kwangsi, Hainan, Tonkin), *O. polysperma* Chen (Kwangtung, Kwangsi, Kiangsi), *O. Fordiana* Oliv. (Kwangtung, Hainan, Kwangsi, Yunnan, Tonkin), *O. Hosiei* Hemsl. & Wils. (Szechuan, Hupeh, Shensi, Kiangsu, but apparently introduced in Shensi and Kiangsu), *O. Merrilliana* Chen (Kwangtung, Kwangsi, Tonkin), *O. indurata* Chen (Kwangtung, Kwangsi), *O. pinnata* (Lour.) Merr. (Kwangtung, Hainan, Annam), *O. semicastrata* Hance (Kwangtung, Kwangsi, Hainan), *O. simplicifolia* Merr. & Chun (Hainan, Tonkin), *O. striata* Dunn (Yunnan, Burma), *O. yunnanensis* Prain (Yunnan, Siam), and *O. xylocarpa* Chun (Hainan, Kwangsi). The most widely distributed species in the Old World is *Ormosia calavensis* Azaola, which extends from northern Luzon to Mindanao in the Philippines, southward and eastward to the Moluccas, New Guinea (Fly River region, *Brass 7514*), and the Palao Islands. The most southern species is *Ormosia Ormondi* (F. Muell.) Merr. of Australia (Queensland).

One is constantly impressed by the local occurrence of most of the species and by the few individual collections representing them, and can only conclude that the majority of the species are not only local, but that many of them are rare. It is noteworthy in this genus, as was the case with the Old World species of *Microtropis,*[1] that not a single species of *Ormosia* even approximates the geographic limits of the genus in range, extending as it does from Assam to Travancore in India (unknown in Ceylon), Burma, Thailand (Siam), Indo-China, central and southern China and Formosa, southward and eastward through the Philippines and the Malay Peninsula to Sumatra, Java, Celebes, the Moluccas, New Guinea, the Palao Islands, and Australia (Queensland).

On the whole we are satisfied that *Ormosia* Jackson, as at present constituted, forms a distinctly natural assemblage and a group where, with reasonably complete material, one can be certain that one is dealing with a representative of this genus. Although it may ultimately be possible to propose and maintain formal subgenera or sections to take certain groups of species, it is felt that such a study should be based on all available material from all parts of the generic range, to include not only the species of the Old World, but also those of America. We have therefore been content, in this study, to propose a group of series, under which we have attempted to assemble certain species that have more or less definite characters in common. We do not think that Ducke's arrangement is applicable to the Old World species, and we are not convinced that Prain's arrangement of the Old World species in certain subgenera, sections and subsections is practicable; attention is called to the fact that Prain emphasized the fact that his arrangement was purely a tentative one. Like ourselves, he was handicapped by having access to inadequate material, for in a group like *Ormosia* one needs not only a large number of individual collections of each species showing ranges of variation in vegetative and other characters, but one also needs a series of specimens in full flower, supplemented by ample material with mature fruits. Unfortunately many Old World species are still known only from flowering specimens, and many more are known from fruiting specimens alone. Until more comprehensive collections are available we do not think that the time has arrived to consider possible subgenera. Like Prain and

[1] **Merrill, E. D. & Freeman, F. L.** The Old World species of the Celastraceous genus Microtropis. Proc. Am. Acad. Arts Sci. **73**: 271–310. 1940 (Mem. Gray Herb. **5**: 271–310).

like Ducke, we have based our arrangement of the species, under the serial names proposed in this paper, largely on the characters of the fruits and the seeds, supplemented by certain vegetative characters.

The objective in this attempt to revise the eastern Asiatic species of *Ormosia* is to enumerate all of the known Chinese and Formosan species, as well as those of Indo-China, to give the more important literature references, to adjust the synonymy, to cite all specimens available to us for study purposes, and to indicate the known range for each species. For the convenience of those who may have occasion to study the genus later an artificial key to the thirty-four recognized species has been prepared. The net result has been to increase the known Chinese species of *Ormosia* from ten to twenty-seven, the additions all being in the form of previously undescribed species.

This paper is based essentially on the material available in the herbarium of the Arnold Arboretum, supplemented by the specimens in the Gray Herbarium, the Britton Herbarium, New York Botanical Garden, some material from the herbarium of Lingnan University, a selected loan from the United States National Herbarium, and a few essential specimens borrowed from the Royal Botanic Gardens, Kew. Mr. J. R. Sealy of Kew examined certain specimens in the Kew Herbarium, where the species involved had been described as having arillate seeds, and his findings confirm our conclusion in that none of the *Ormosia* species has arillate seeds. We are indebted to Dr. H. Humbert of the Museum of Natural History, Paris, France, for his courtesy in supplying fragments of the described Indo-Chinese species. We wish to take advantage of this opportunity to express our appreciation and gratitude to the officials of the several herbaria for their kind co-operation.

The types of the new species herein described, unless otherwise stated, are deposited in the herbarium of the Arnold Arboretum. The abbreviations adopted in this paper to indicate the herbaria in which the cited specimens are deposited are as follows:

A. Arnold Arboretum, Harvard University.
G. Gray Herbarium, Harvard University.
K. Royal Botanic Gardens, Kew.
L. Lingnan University, Canton.
N. Britton Herbarium, New York Botanical Garden, New York.
NA. National Arboretum Herbarium, U. S. Department of Agriculture, Washington.
P. Museum d'Histoire Naturelle, Paris.
U. United States National Herbarium, Washington.

Ormosia Jackson in Trans. Linn. Soc. **10**: 360. *t. 25–27.* 1811.—Benth. Fl. Hongk. 95. 1861.—Benth. & Hook. f. Gen. Pl. **1**: 556. 1865.—Taubert, Engl. & Prantl, Nat. Pflanzenfam. **3**(3): 194. 1892.—Prain, Jour. As. Soc. Beng. **69**(2): 175. 1900 (Bot. Notes Pap. 385. 1901).—Chun, Chinese Econ. Trees. 185. 1922.

Toulichiba Adans. Fam. **2**: 326. 1763.

Layia Hook. & Arn. Bot. Beech. Voy. 182. *t. 38.* 1833, non *Layia* Hook. & Arn. op. cit. 142 (1833), 357 (1838), DC. Prodr. **7**: 294. 1838.

Hormosia Reichenbach, Repert. Herb. Nomencl. 154. 1841.

Macrotropis sensu Miq. Fl. Ind. Bat. Suppl. 302. 1862, non DC.

Chaenolobium Miq. Fl. Ind. Bat. Suppl. 302. 1862.

Arillaria Kurz, Jour. As. Soc. Beng. **42**(2): 70. 1873.

Podopetalum F. Muell. Melbourne Chem. Drugg. **5**: 12. 1882, Bot. Centralbl. **12**: 125. 1882; F. M. Bail. Queensl. Fl. **2**: 447. 1900; non Gaudin, 1828.

This is a distinctly natural group, in general easily recognizable by its floral and its fruit characters. Because numerous excellent generic descriptions have been published it has not been considered necessary to repeat these data here. Some modifications are mentioned in the text above, together with certain unusual characters that we have noted in certain species.

There are somewhat more than ninety known species, including those proposed and described as new in this paper. The generic range in the New World is from Mexico and the West Indies to Brazil and Peru, and in the Old World from Assam in northern India through western, central, and eastern China, southward and eastward through the Philippines and Malaysia to Sumatra, Java, Celebes, the Moluccas, New Guinea, the Palao Islands and Queensland, Australia. The few native African species that have been placed in *Ormosia* are now disposed of as representatives of the allied genera *Afrormosia* Harms and *Haplormosia* Harms.

The type of the genus is *Ormosia coccinea* Jackson, a native of British Guiana. In comparing the Old World and the New World species, while, as one would expect, there is no indication of specific identity as between Old World and New World forms, there is in general a rather remarkable similarity in the salient features of the American and the Asiatic species, but at the same time a rather broad range of variation in vegetative characters as well as those of flower, pod, and especially in the seed characters of the various representatives of the genus in the two widely separated geographic areas. The so-called "aril" that has been described for a few Old World species is discussed above, p. 85, our conclusion being that all described species of *Ormosia* have non-arillate seeds, although in one species, *O. robusta* (Roxb.) Wight, the fleshy seed coats were erroneously interpreted to represent an aril, and in two others, *O. macrodisca* Baker and *O. gracilis* Prain, the characteristic black basal parts of the seed coats were inadvertently characterized as representing an aril. In most of the Old World species the colored seeds are hard, smooth, and shining, although in a few cases the integuments are distinctly crustaceous or fleshy and easily separable from the cotyledons.

After considering possible subdivisions of the genus as represented in the area covered by this paper and examining such extra-limital material as was available to us, we abandoned the idea of arrangement under formal subgeneric and sectional names, and we have been content to group the included thirty-four species in fifteen series. For these we provide the following synopsis. After the synopsis of the series we present an artificial key to the species recognized. When more material is available this tentative arrangement will doubtless be greatly modified, for we would call attention to the fact that of the thirty-four species recognized, fifteen of them are known from single collections only, while of five the fruits are as yet unknown.

Synopsis of the series

A. Hilum small, 1–3 mm. long.

B. Testa in mature seeds crustaceous, often fragile, easily separable from the cotyledons, black, brown or red, when red more or less fleshy when fresh.

C. Testa black, castaneous or brown.

Series 1. Pachycarpae

Plants very pubescent; leaf-rachis not produced above the insertion of the upper pair of leaflets or, if produced, then very slightly so; pods inflated, densely velvety-pubescent externally, the valves thickly coriaceous; seeds black or black

tinged with brown or uniformly castaneous, never red, the testa usually very coarsely wrinkled when dry, somewhat shining, more or less crustaceous and easily separable from the cotyledons; seeds 1.5–2.5 cm. long.

This is a very uniform series, consisting of three closely allied species, *Ormosia pachycarpa* Champ., *O. inflata* Merr. & Chun, and *O. Merrilliana* Chen, the seed characters being totally different from those of all other series. In Prain's classification, *Ormosia pachycarpa* was placed in the subsection *Chaenolobium*, the other species of which, as far as known, have uniformly red seeds.

Series 2. Longipes

Glabrous or nearly glabrous, the leaflets chartaceous, the rachis produced; pods ellipsoid or oblong-ellipsoid, with a single large seed, the testa thin, crustaceous, pale brown, fragile, easily separable from the cotyledons, the valves coriaceous-crustaceous, glabrous, rugose, thin, only about 1 mm. thick.

A single species, *Ormosia longipes* Chen.

CC. Testa in mature seeds uniformly red.

Series 3. Fordianae

Pods large, compressed, glabrous, the valves very thickly coriaceous, usually stained red on the inside opposite the seeds; seeds 1–3, fairly large, ellipsoid, 2–3 cm. long, the red testa crustaceous, fragile, free from the cotyledons when dry, somewhat fleshy when fresh, simulating an aril.

A single species, *Ormosia Fordiana* Oliv.

BB. Testa indurated, not easily separable from the cotyledons, and never crustaceous, usually smooth and shining, sometimes wrinkled.

C. Seeds large, about 3 cm. long, the testa either jet black and with a red band surrounding the margins or uniformly mahogany-red.

Series 4. Crassivalvae

Pods with very thick, glabrous, woody, convex valves, strictly 1-seeded; seeds large, 3 cm. long, the testa hard, shining, uniformly black or black and brownish red, and with a distinct red band surrounding the margins, or uniformly mahogany-red.

Two species in Indo-China, *Ormosia crassivalvis* Gagnep. and *O. cambodiana* Gagnep.

CC. Seeds small, less than 2 cm. long, uniformly red when mature.

D. Leaves simple.

Series 5. Simplicifoliae

Leaves simple; pods compressed, glabrous, oblong-elliptic to obovate, the valves thickened (2 mm.), rugose when dry; seeds 1–3, oblong-ellipsoid, up to about 1.6 cm. long, the testa hard, red, somewhat shining, more or less coarsely rugose when dry, when mature often distinctly viscid.

A single species, *Ormosia simplicifolia* Merr. & Chun.

DD. Leaves pinnate.

E. Pods subcylindric, the valves much thickened.

Series 6. Striatae

Glabrous, the mature pods subterete, smooth, glabrous, woody, the valves much thickened (to at least 3 mm. thick), when more than one-seeded then non-septate or only partly septate between the seeds; calyx and ovary glabrous.

A single species, *Ormosia striata* Dunn.

Series 7. Pinnatae

Similar to the preceding, but the pods when more than one-seeded distinctly septate and depressed between the seeds, the calyx and ovary densely pubescent.

Two species, *Ormosia pinnata* (Lour.) Merr. and *O. indurata* Chen.

EE. Pods much compressed, never cylindric or subcylindric, the valves thick or thin.

F. Valves surrounded by a thick wing-like extension 5–15 mm. wide surrounding the seed-bearing part, which is but 2.5 cm. wide.

Series 8. Pachypterae

Pods obovate, compressed, glabrous, the valves thick, woody, their margins extended as a thick wing-like projection 5–15 mm. wide, but attenuate at the base, surrounding the at most 2.5 cm. wide seed-bearing parts, the seeds several, hard, smooth, red, shining, up to 1.5 cm. long.

Two species, *Ormosia pachyptera* Chen and *O. purpureiflora* Chen (fruits of the latter unknown).

FF. Valves not extended as a free projection beyond the seed-bearing parts.

Series 9. Xylocarpae

Pods strongly compressed, densely short-pubescent, the valves much thickened, woody, septate between the seeds; seeds hard, red, smooth, shining, one or few to as many as 9.

Two species, *Ormosia xylocarpa* Chun and *O. polysperma* Chen.

Series 10. Sericeolucidae

Pods strongly compressed, usually 1- or 2-seeded, the valves (immature) crustaceo-coriaceous, externally densely short-pubescent; in indumentum and in vegetative characters suggesting *Xylocarpae*.

One species, *Ormosia sericeolucida* Chen.

Series 11. Layia

Pods compressed, glabrous or nearly so, the valves somewhat thickened, rigid, more or less woody, normally several-seeded and septate between the seeds when more than 1-seeded, the hard red shining seeds one or few to many.

A rather incongruous assemblage consisting of *Ormosia emarginata* (Hook. & Arn.) Benth., *O. kwangsiensis* Chen, *O. Henryi* Prain, *O. formosana* Kaneh., *O. microphylla* Merr., and *O. olivacea* Chen. This is the genus *Layia* Hook. & Arn., typified by *Ormosia emarginata* (Hook. & Arn.) Benth, disposed of by Prain in the subsection *Layia* of *Ormosia* proper, subgenus *Toulichiba*.

Series 12. Amacrotropis

Not very different from the preceding series but the pods, when 2-seeded, not septate between the seeds.

A single species in China, *Ormosia yunnanensis* Prain. This series name was first proposed by Miquel, Fl. Ind. Bat. Suppl. 294. 1861, as a section of *Macrotropis*, as he realized that his species *Macrotropis sumatrana* Miq. = *Ormosia sumatrana* Prain differed from de Candolle's description of *Macrotropis* in having the vexillum as long as the other petals. It is typified by the first species that Miquel described, and Prain disposed of it as subsection *Amacrotropis* of section *Ormosia* proper, subgenus *Toulichiba*. *Macrotropis* as interpreted by Miquel is *Ormosia*, but *Macrotropis* DC. is, at least for the most part, a synonym of *Sophora* Linn.; see p. 115.

Series 13. Semicastratae

Stamens, as far as flowers are known, 5 only (only flowers of *O. semicastrata* Hance known), two to four very slender staminodes or sterile filaments being present; pods small (up to 2 cm. long), compressed or more or less inflated, strictly 1-seeded, suborbicular to elliptic, equilateral or more or less inequilateral, the valves crustaceo-coriaceous, not greatly thickened or woody; seeds small, usually slightly wider than long, the hilum small, less than 3 mm. long.

Five species, *Ormosia semicastrata* Hance, *O. apiculata* Chen, *O. cathayensis* Chen, *O. Howii* Merr. & Chun, and *O. nanningensis* Chen.

AA. Hilum large, 7–15 mm. long.

Series 14. Hosieae

Ovaries and pods glabrous, the latter ovate, compressed, 1- or rarely 2-seeded, the valves somewhat thickened, woody, the seeds normally wider than long, the testa uniformly red, hard, shining, smooth, the hilum elongated, prominent, about 7 mm. long.

A single species, *Ormosia Hosiei* Hemsl. & Wils.

Series 15. Balansae

Distinguished from all other series in its very long hilum, extending about halfway around the seed and 12 to 15 mm. long. Ovaries and pods densely pubescent, the latter more or less inflated, 1-seeded, the valves crustaceo-coriaceous, very tardily dehiscent or indehiscent, the seeds uniformly red, the testa hard, smooth, shining.

A single species, *Ormosia Balansae* Drake.

Unplaced species

A series of unrelated species of which only the flowers are known, or, in one case, very young fruits, the seeds not formed. A more definite placement of these must await the collection of additional material with mature or nearly mature fruits. Four species, all from Indo-China, *Ormosia euphorioides* Pierre, *O. hoaensis* Pierre, *O. tonkinensis* Gagnep., and *O. Tsangii* Chen.

Artificial key to the eastern Asiatic species of Ormosia

A. Leaves always simple (Hainan, Tonkin) ..... 8. *O. simplicifolia.*

A. Leaves pinnate.

B. Seeds very large, solitary, 3 cm. long, the seed coats hard, smooth, shining, uniformly mahogany-red or jet black (sometimes somewhat mottled with red) and with a distinct red band surrounding the edges; mature pods glabrous, the valves convex, much thickened, woody.

C. Pods 6–7 × 4.5 cm.; seeds jet black or black mottled with red, their margins with a distinct red band 2 to 5 mm. wide; leaflets shortly blunt-acuminate, somewhat pubescent beneath (Cochinchina) ..... 6. *O. crassivalvis.*

C. Pods 6 × 2.8 cm.; seeds uniformly mahogany-red; leaflets slenderly and sharply caudate-acuminate, wholly glabrous (Cambodia) ..... 7. *O. cambodiana.*

B. Seeds ellipsoid or oblong-ellipsoid, 2–2.5 cm. long (or when fresh 3 cm. long), the seed coats not indurated, when dry red, crustaceous, fragile and free or nearly free from the cotyledons, somewhat fleshy when fresh, simulating an aril; pods large, compressed, the valves often shining inside and more or less stained with red opposite the seeds (Kwangtung, Kwangsi, Yunnan, Tonkin) ..... 5. *O. Fordiana.*

B. Seeds mostly smaller, never more than 2.5 cm. in diameter if globose or subglobose, mostly oblong, ellipsoid or orbicular and more or less compressed, and from less than 1 cm. to 1.8 cm. in length, one to many in a pod, the seed coats mostly very hard, smooth, shining and uniformly red, sometimes more or less crustaceous and free or nearly free from the cotyledons and if so then black, castaneous, or brown; pods various.

C. Seed coats black or black tinged with brown or castaneous, more or less crustaceous and free or nearly so, never greatly indurated, dull or more or less shining but never red, when dry smooth or very coarsely wrinkled; leaf-rachis not normally produced above the upper pair of leaflets or, if so, then very shortly; leaflets conspicuously pubescent beneath; pods more or less inflated, the somewhat leathery-thickened valves very densely subvelutinous-pubescent externally.

D. Seed coats uniformly castaneous, fragile, free; leaflets chartaceous (Hainan). 3. *O. inflata.*

D. Seed coats black, occasionally tinged with brown; leaflets coriaceous.

E. Indumentum on the branchlets, inflorescences, leaf-rachises, and lower surfaces of the leaflets very densely woolly (Hongkong) .....1. *O. pachycarpa.*

E. Indumentum on various parts of the plant dense but never woolly (Kwangtung, Kwangsi, Tonkin) .....2. *O. Merrilliana.*

C. Seed coats pale brown, thin, and fragile; valves crustaceous, glabrous; leaf-rachis strongly produced above the upper pair of leaflets; all parts of the plant (flowers unknown) glabrous (Yunnan) .....4. *O. longipes.*

C. Seeds mostly hard, small, uniformly red (or sometimes brownish when immature), the seed coats mostly hard, smooth or sometimes wrinkled when dry, shining, the seeds from less than 1 cm. to 1.5 or 1.8 cm. long or, if longer, then the red seed coats crustaceous when dry, fragile, and loose from the cotyledons; pods various; leaf-rachis mostly produced above the upper pair of leaflets.

D. Mature pods wholly glabrous or at most with a few scattered hairs; ovaries entirely glabrous or pubescent along their margins, rarely uniformly pubescent.

E. Leaflets conspicuously pubescent beneath, the indumentum uniformly distributed or sometimes confined to the midribs and lateral nerves.

F. Leaflets about 15, small, 2–4 × 1.5 cm., more or less appressed subferruginous-pubescent beneath (Kwangsi) .....21. *O. microphylla.*

F. Leaflets few to many, very much larger, 8–15 × 2.5–5 cm.

G. Leaflets about 17, membranaceous, olivaceous; pods about 3-seeded, 7 cm. long, the valves rather thinly coriaceous (Yunnan) .....22. *O. olivacea.*

G. Leaflets 5–11, coriaceous.

H. Pods much inflated opposite the seeds, 2–3.5 cm. long, about 1.5 cm. wide, 1- or 2-seeded; leaflets brown beneath, villous especially on the midrib and lateral nerves (Yunnan) .....23. *O. yunnanensis.*

H. Pods strongly compressed, 3–12 × 2.5–3.5 cm.; seeds usually many (up to a maximum of 10), sometimes in not well developed pods few only; leaflets pale, softly and uniformly pubescent beneath (central and southern China) .....19. *O. Henryi.*

E. Leaflets wholly glabrous or at most with a few widely scattered hairs beneath especially when young, never conspicuously and uniformly pubescent.

F. Pods ovoid to oblong, subcylindric or only very slightly compressed when mature, the valves very much thickened, woody; calyx and ovary glabrous (Yunnan, Burma) .....9. *O. striata.*

F. Pods various, mostly compressed, but if cylindric or subcylindric then the calyx and ovary densely pubescent.

G. Leaflets broadly obtuse or rounded, conspicuously retuse; calyces glabrous or very slightly pubescent outside, black when dry; pods mostly 2- or 3-seeded (Kwangtung, Kwangsi, Hainan, Tonkin) .....17. *O. emarginata.*

G. Leaflets acute or acuminate, or if the tips are sometimes also slightly emarginate the calyces brown, densely pubescent, and the pods strictly 1-seeded.

H. Leaflets 11–17.

I. Rachis without glands between the insertion of the leaflets; leaflets obtuse or subacute, never acuminate, very minutely apiculate; flowers purple; pods unknown (Kwangtung) .....13. *O. purpureiflora.*

I. Rachis with distinct glands on the upper surface between each pair of leaflets; leaflets slenderly subcaudate-acuminate and apiculate; pods obovate, woody, compressed, to 4.5 cm. wide, the edges of the valves extended as a thick wing-like projection 5 to 15 mm. wide, quite surrounding the seed-bearing part which is but 2.5 cm. wide (Kwangsi). 12. *O. pachyptera.*

H. Leaflets 3–9.

I. Seed coats red, crustaceous and free when dry, more or less fleshy when fresh, the seeds, when dry, up to 2.5 cm. long; pods 4–7 cm. long, about 5 cm. wide, the thickened valves pale and often shining inside, usually stained red opposite the seeds by the red testa (Kwangtung, Kwangsi, Yunnan, Tonkin) .....5. *O. Fordiana.*

I. Seed coats hard, smooth, shining, never crustaceous and free, the seeds 1 cm. long or less; pods various, not as above.

J. Pods 4–6.5 × 2–3 cm., ovate to oblong-ovate, strongly compressed; seeds mostly 2, the hilum 7 mm. long (Shensi, Hupeh, Szechuan, Kiangsu, sometimes planted) .....29. *O. Hosiei.*

J. Pods normally several-seeded, obovate to oblong, compressed or turgid or even subterete, 3–7 × 1.5–2.5 cm.; hilum less than 3 mm. long; flowers (as far as known) with 10 stamens.

K. Leaflets oblanceolate to oblong-oblanceolate, 2.5–6 cm. long; pods very woody, more or less turgid, mostly obovate to oblong-obovate (Kwangtung, Kwangsi) .....11. *O. indurata.*

K. Leaflets never oblanceolate-obovate or oblong-oblanceolate, 7–11 cm. long.

L. Pods almost cylindric when mature, or at least very turgid, the valves much thickened; seeds mostly 1.5–1.8 cm. long, the red testa wrinkled when dry; lateral nerves elevated beneath, distinctly prominent (Kwangtung, Hainan, Annam)..10. *O. pinnata.*

L. Pods much compressed, flat when mature; seeds 10–12 mm. long, the red testa hard, smooth, shining; lateral nerves not prominent.

M. Pods 1- or 2-seeded; ultimate reticulations lax, about 2 mm. in diameter, the ultimate veinlets distinctly elevated; leaflets glabrous beneath (Kwangsi) .....18. *O. kwangsiensis.*

M. Pods 2–5-seeded; ultimate reticulations crowded, indistinct, about 1 mm. in diameter, the ultimate veinlets scarcely elevated; leaflets minutely pubescent beneath with widely scattered short appressed hairs (Formosa) .....20. *O. formosana.*

J. Pods up to 2 cm. long, in general ovate to broadly elliptic-ovate, elliptic, or suborbicular, equilateral or inequilateral, strictly 1-seeded; hilum about 1 mm. long; flowers (as far as known) with 5 stamens.

K. Pods very strongly compressed, distinctly wider than long, with a prominent curved apiculum 4–6 mm. long (Kwangsi).
25. *O. apiculata.*

K. Pods, at least when mature, more or less inflated or turgid, always longer than wide, the apiculum short, straight or nearly so, 3 mm. long or less.

L. Pods equilateral or subequilateral, broadly elliptic to suborbicular, about 1.5 cm. long (Kwangtung, Kwangsi, Hainan).
24. *O. semicastrata.*

L. Pods distinctly inequilateral, mostly rhombic-ovate or subrhombic.

M. Pods about 1.5 cm. long and 1 cm. wide; leaf-rachis produced 1.2–2 cm. above the insertion of the upper pair of leaflets, the latter firmly chartaceous to subcoriaceous; nerves and reticulations very slender, scarcely elevated (Kwangtung).
26. *O. cathayensis.*

M. Pods about 2 cm. long and nearly as wide; leaf-rachis produced only 3–6 mm. above the insertion of the upper pair of leaflets, the latter thickly and rigidly coriaceous; nerves and reticulations more or less impressed on the upper surface and raised on the lower surface (Hainan) .....27. *O. Howii.*

D. Mature pods conspicuously and uniformly pubescent, the indumentum often short (pods unknown in *O. euphorioides, O. hoaensis* and *O. tonkinensis*); ovaries densely pubescent.[1]

[1] This character for *O. euphorioides* Gagnep. is uncertain, as in his original description as well as in his subsequent one and in his key, Gagnepain states that the ovary is glabrous on the sides and pubescent on the margins; yet his detailed figure of the ovary, Fl. Gén. Indo-Chine 2: 509. *f. 49, 1–6.* 1920, depicts it as being densely pubescent on all parts except the very tip.

E. Leaflets entirely glabrous.
F. Leaflets large, mostly 3–6 cm. wide, rounded or obtuse, never acuminate (Cochinchina) .....32. *O. hoaensis.*
F. Leaflets smaller, mostly less than 3 cm. wide, always more or less acuminate.
G. Leaflets shining on the upper surface; pods very shortly and bluntly acuminate (Kwangsi) .....28. *O. nanningensis.*
G. Leaflets dull, the pods long rostrate-acuminate (Tonkin)....34. *O. Tsangii.*
E. Leaflets distinctly pubescent or puberulent beneath, often densely so, the indumentum various but often restricted to short, appressed, shining, densely arranged or scattered hairs.
F. Leaflets 5–9, firmly chartaceous or subcoriaceous, the indumentum on the lower surface pilose or tomentose, the hairs more or less elongated, not strictly appressed.
G. Leaflets 5–9, subchartaceous, 3–6 cm. long, shortly and bluntly acuminate, the nerves beneath very prominent (Tonkin) .....33. *O. tonkinensis.*
G. Leaflets 5–7, subcoriaceous, 6–10 cm. long, usually attenuate-obtuse, the nerves beneath slender but not particularly prominent (Cochinchina). 31. *O. euphorioides.*
F. Leaflets 3–7, rigidly coriaceous, the indumentum consisting of dense or scattered, very short, usually closely appressed shining hairs.
G. Hilum short, at most 2 mm. long.
H. Seeds 1 or at most 2; valves crustaceo-coriaceous, about 1 mm. thick; leaflets densely and uniformly short appressed-pubescent beneath (Kwangsi) .....16. *O. sericeolucida.*
H. Seeds normally several, up to as many as 9, sometimes one only; valves much thickened, very woody.
I. Leaflets 4–8 cm. long; mature seeds often distinctly viscid (Hainan). 14. *O. xylocarpa.*
I. Leaflets 8–15 cm. long; seeds (immature) not viscid (Kwangtung, Kiangsi, Kwangsi) .....15. *O. polysperma.*
G. Hilum very long, extending about halfway around the seed and up to 15 mm. in length; pods ovate to orbicular-ovate, tardily dehiscent (or perhaps even indehiscent), 1- or rarely 2-seeded, the valves thin; leaflets large, 8–15 cm. long (Kwangsi, Hainan, Tonkin) .....30. *O. Balansae.*

Series 1. Pachycarpae

1. **Ormosia pachycarpa** Champ. ex Benth. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 76. 1852; Benth. Fl. Hongk. 96. 1861; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 204. 1887; Prain, Jour. As. Soc. Bengal **69**(*2*): 184. 1900 (Bot. Notes Pap. 394. 1901); Dunn & Tutch. Kew Bull. Add. Ser. **10**: 88. 1912; Chun, Sci. Jour. Col. Sci. Sunyatsen Univ. **2**(3): 56. 1930; Tsiang, Jour. Forest. Assoc. China **3**: 43. 1930; Hu & Chun, Ic. Pl. Sin. **4**: 16. *t. 166.* 1935.

China: Hongkong, *Ford s.n.* (A, N), *Hongkong Herb. 7259* (A), *W. Y. Chun 6073, 7453* (A).

In the original description the binomial was published thus: *"Ormosia ? (Marquartia ?) pachycarpa* Champ., sp. n." The species being a true *Ormosia,* the question mark is eliminated; *Marquartia* Vogel is a synonym of *Millettia* Wight & Arn. The species is characterized by having the lower surface of the leaflets, the petioles, the inflorescences, and the outside of the pods covered with a dense felt-like indumentum. While Champion described the seeds as brownish red and Hu and Chun repeat this, stating that they are 1.8 to 2.5 cm. long, fully mature seeds of our Hongkong specimens are mostly subglobose to irregularly ovoid, black or with a somewhat brownish tinge, and 1.5 to 2 cm. long; the seed coats are distinctly crustaceous and, although firm, are easily separable from the cotyledons. The species is known only from Hongkong. Prain placed this species in his subgenus *Toulichiba,* section *Chaenolobium* (Miq.) Prain, the group being characterized by the leaf-rachis not being produced above the in-

sertion of the upper pair of leaflets, but several of the specimens above cited have leaves with the rachis shortly produced and others not at all produced, even on the same branchlet, thus providing evidence that this character alone is not a sufficiently dependable one on which to establish subdivisions of *Ormosia*. *Chaenolobium* was proposed by Miquel (as a genus) to take two Sumatran species, *C. septemjugum* Miq. = *Ormosia septemjuga* Prain and *C. decemjugum* Miq. = *O. decemjuga* Prain, of which Miquel did not describe the seed characters, although he did have pods of the latter. As far as we know the seeds have never been described, and we can only assume that they are red. *O. venosa* Prain and *O. polita* Prain, placed in *Chaenolobium* by Prain, have hard red seeds.

2. **Ormosia Merrilliana** Chen, sp. nov.

Arbor 6–16 m. alta; ramis glabris vel subglabris, ramulis densissime breviter ferrugineo-pubescentibus; foliis pinnatis, 25–30 cm. longis, rhachi tomentosa, ultra jugum ultimum foliolorum haud producta; foliolis 5–9, subcoriaceis, late oblongo-oblanceolatis, oblanceolatis, vel oblongo-ellipticis, 9–20 cm. longis, 3.5–6 cm. latis, breviter sed distincte acuminatis, deorsum plerumque plus minusve angustatis, basi cuneatis vel late acutis, supra pallide olivaceis, glabris, costa impressa, subtus subcinereo- vel luteo-brunneis, densissime uniformiter breviter velutino-tomentosis; nervis primariis utrinsecus 12–17, utrinque distinctis, supra planis, subtus elevatis, ad marginem arcuato-anastomosantibus, venulis secundariis subtus distinctis, reticulatis; petiolulis 5 mm. longis, crassis, densissime breviter pubescentibus; inflorescentiis terminalibus, paniculatis, dense tomentosis, ad 30 cm. longis, ramis primariis paucis, patulis, inferioribus ad 12 cm. longis, pedicellis 5 mm. longis, bracteis bracteolisque deciduis; floribus parvis, calycis lobis oblongis, 4 mm. longis, 3 mm. latis, dense ferrugineo-tomentosis; petalis glabris, vexillo breviter unguiculato, late orbiculari, 1.2 cm. longo, obovato, basi late acuto haud auriculato, breviter unguiculato, alis carinisque longe (3.5 mm.) unguiculatis, carinarum laminis 2.8 mm. latis, basi uno latere leviter auriculatis, altero acutis, alarum laminis late oblongis, aequilateralibus, basi late rotundatis leviter biauriculatis; staminibus 10, liberis, filamentis glabris, 6–12 mm. longis; ovario oblongo-ovoideo, sessili, dense villoso, 1-ovulato; stylo filiformi, 10 mm. longo, uno latere ad basim pubescente; leguminibus orbiculari-ovoideis vel obovoideis, 1-spermis, inflatis, ad 4 cm. longis, 2.5–3.5 cm. latis, saltem 1.5 cm. crassis, haud stipitatis, basi late rotundatis, apice obtusis vel breviter apiculatis, valvis crasse coriaceis, extus in sicco laxissime rugosis, subcastaneis, densissime subvillosis, pilis longioribus nitentibus, intus conspersissime villosis; seminibus solitariis, atro-castaneis vel atris, subnitidis, duris, in sicco laxe rugosis, suborbiculari-obovoideis, leviter compressis, 1.7–2 cm. longis, 2–2.5 cm. latis, 1–1.2 cm. crassis, hilo minuto, 1 mm. longo.

China: Kwangtung, Yamchow, *K. K. Ts'oong 1921* (A); Kung P'ing Shan, Fang Ch'eng District, on the Kwangtung-Tonkin border, *W. T. Tsang 28615*, Sept. 1–9, 1936, a tree 6 m. high, fairly common in thickets on dry clayey soil, fruits brown; Kwangsi, Shap Man Taai Shan, Na Wai Village, southeast of Shangsze, Shangsze District, on the Kwangtung border, *W. T. Tsang 23839* (type A), July 11–30, 1934, fairly common in thickets. Indo-China: Tonkin, Taai Wong Mo Shan, immediately south of the juncture of the Kwangtung-Kwangsi-Tonkin boundaries, *W. T. Tsang 27144* (A), Nov. 19, 1936, fairly common in thickets, fruit brownish yellow.

This species, manifestly allied to *Ormosia pachycarpa* Champ. of Hongkong, is well characterized by its large leaflets, their shape and indumentum, and by its inflated, 1-seeded pods, the rather large seeds being black as in Champion's species rather than red as in most of the other species of the genus in Asia and Malaysia.

3. **Ormosia inflata** Merr. & Chun in herb. sp. nov.

Ormosia inflata Merr. & Chun ex Tanaka & Odashima, Jour. Soc. Trop. Agr. **10**: 369. 1938 (Contr. Hort. Inst. Taihoku Univ. **24**: 369), *nomen nudum*.

Arbor 6–10 m. alta, ramulis et subtus foliis et inflorescentiis perspicue dense pubescentibus, ramis incrassatis, glabris, teretibus, ramulis ultimis circiter 2 mm. diametro, subdense breviter pubescentibus; foliis pinnatis, 12–18 cm. longis, rhachi ultra jugum foliolorum ultimum haud producta, petiolis dense breviter pubescentibus; foliolis 5–7, chartaceis, oblongo-oblanceolatis, oblongis, vel oblongo-ellipticis, 6–11 cm. longis, 1.5–3.5 cm. latis, graciliter acute acuminatis, basi acutis, in sicco supra viridibus, glabris, subtus subferrugineis vel brunneis, perspicue pubescentibus, costa supra impressa, subtus valde elevata, nervis primariis utrinsecus 10–15, supra obscuris, subtus elevatis, perspicuis, ad marginem arcuato-anastomosantibus, reticulationibus distinctis; petiolulis dense pubescentibus, 3–5 mm. longis; inflorescentiis paniculatis, circiter 15 cm. longis, dense pubescentibus, multifloris, ramis primariis paucis, ad 9 cm. longis; floribus albidis, circiter 1.2 cm. longis, breviter pedicellatis, calycibus extus dense brunneo-tomentosis, tubo circiter 4 mm. longo, lobis ovatis vel oblongo-ovatis, obtusis, 3–4 mm. longis, 2–3 mm. latis, utrinque dense villosis; vexillo suborbiculari, retuso, circiter 10 mm. diametro, basi late rotundato, abrupte decurrente, haud calloso, unguiculo 2.5 mm. longo; alis carinisque plus minusve inaequilateralibus, apice obtusis, circiter 4 mm. latis, basi uno latere acutis, altero distincte auriculatis, unguiculis circiter 3 mm. longis; staminibus 10, filamentis liberis, glabris; ovario inaequilateraliter oblongo-ovoideo, densissime villoso, 2- vel 3-ovulato, stylo ad 12 mm. longo, deorsum leviter villoso; fructibus inflatis, ovoideis vel ellipsoideis, 3–5 cm. longis, 2–2.5 cm. latis, circiter 1.5 cm. crassis, valvis crasse coriaceis, intus glabris, extus densissime brunneo-tomentosis; seminibus solitariis vel binis, subellipsoideis vel suborbicularibus, castaneis, nitidis, 1.5 cm. longis, leviter compressis, ad 1 cm. crassis, tegumento in sicco crustaceo, fragili, e cotyledonibus facile secedibili, hilo 1 mm. longo.

China: Hainan, Po-ting, *F. C. How 72604, 73973* (A), May 26 and Nov. 3, 1935, in forests along streams, altitude about 350 m., *S. K. Lau 28020* (A type, N), Oct. 17, 1936, a tree about 6 m. high.

A third species in the group with *Ormosia pachycarpa* Champ., characterized by its slenderly acuminate leaflets, but having much the aspect and many of the characters of Champion's Hongkong species. The seed coats are shining and uniformly castaneous when dry, not black as in the two preceding species, very easily separable from the cotyledons and distinctly more fragile than in *O. pachycarpa* Champ. and *O. Merrilliana* Chen.

Series 2. Longipes

4. **Ormosia longipes** Chen, sp. nov.

Arbor circiter 6 m. alta, ramis brunneis, glabris, ramulis glabris vel obscure pubescentibus; foliis pinnatis, 25–36 cm. longis, rhachi glabra vel subglabra, ultra jugum foliolorum ultimum 3–15 mm. producta; foliolis 7, chartaceis, glaberrimis, anguste oblongis vel late oblongo-lanceolatis, 12–20 cm. longis, 2.5–5.5 cm. latis, apice sat distincte graciliterque acuminatis, basi acutis vel cuneatis, supra viridibus vel olivaceis, subtus pallidis; venis primariis utrinsecus 8–10, perspicuis, adscendentibus, subtus elevatis, arcuato-anastomosantibus; petiolulis crassis, rugosis, 5–8 mm. longis; inflorescentiis ut videtur paniculatis, pauciramosis, ramis (saltem sub fructu) 22 cm. longis, glabris; leguminibus stipitatis (stipite ad 5 mm. longo) ellipsoideis vel oblongo-ellipsoideis, 3.5–4 cm. longis, 2.5 cm. latis, ad 2 cm. crassis, valvis coriaceis, subcrustaceis, subinduratis, circiter 1 mm. crassis, brunneis vel nigris, glabris, rugosis; seminibus solitariis vel binis, ob-

longis vel ovoideis, circiter 2–2.5 cm. longis et 1.5 cm. latis, tegumento in sicco crustaceo, pallide brunneo, fragili, e cotyledonibus facile secedibili.

China: Yunnan, southeast of Mengtze, *Henry 11854* (A type, N), a tree about 20 feet high in forests, alt. about 1500 m. The New York sheet is marked as from Wa Ke, Chinese collector *Ho*.

A species not closely allied to any other one known to us, characterized by being glabrous or nearly so (flowers unknown), as well as by its scarcely compressed, 1-seeded, ellipsoid to oblong-ellipsoid pods, distinctly thin, glabrous and rugose, somewhat fragile valves, and its large seeds, the seed coats being pale brown when dry, not black or red, thin, crustaceous, fragile, and easily separable from the cotyledons.

Series 3. Fordianae

5. **Ormosia Fordiana** Oliv. Hook. Ic. **25**: *t. 2422.* 1895; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 88. 1912; Merr. Lingnan Sci. Jour. **5**: 91. 1928; Chun, Sci. Jour. Col. Sci. Sunyatsen Univ. **2**(3): 54. 1930; Hu & Chun, Ic. Pl. Sin. **4**: 17. *t. 167.* 1935.

Indo-China: Tonkin, Sai Wong Mo Shan, *W. T. Tsang 29987, 30063* (A). China: Kwangtung, *Y. Tsiang 791* (A, N, U), *1539* (A, N, L); Hainan, *CCC 8132* (*McClure*) (A, N), *CCC 9756* (*McClure*) (N), *LU 17859* (*Tsang & Fung*) (A, N), *18027* (*Tsang & Fung*) (A), *C. Wang 35758* (A, N), *F. C. How 70397* (A, N), *72403, 72421, 72898, 72949, 73329* (A); Kwangsi, *R. Ç. Ching 7393* (A, U), *7866* (N, L), *8480* (A, N, U), *W. T. Tsang 22060, 23210* (A), *H. Y. Liang 69826* (A); Yunnan, *H. T. Tsai 61801* (A), *C. W. Wang 78153, 79496* (A).

Ormosia Fordiana Oliv. is distinguished by its large, compressed, woody pods which are smooth and shiny inside, often ivory-like in color and stained more or less reddish opposite the seeds. The seed character is strongly contrasted to the majority of the species in that the seed coats, instead of being hard, smooth and shining, while uniformly red, are crustaceous and fragile when dry, free from the cotyledons, thus simulating an aril, and when fresh somewhat fleshy as in *Ormosia robusta* (Roxb.) Wight, although not in the slightest allied to the latter species in other characters. The seeds are ellipsoid, 1.5–2.5 cm. long.

Series 4. Crassivalvae

6. **Ormosia crassivalvis** Gagnep. Not. Syst. **3**: 29. 1914, et in Lecomte, Fl. Gén. Indo-Chine **2**: 513. 1920.

Indo-China: Cochinchina, *Thorel 1415* (A, U), type coll., from the Saigon River and the Cai-cong forest.

Ormosia crassivalvis Gagnep. seems clearly to be closely allied to the next species. Both have similar, glabrous, 1-seeded pods, the valves being very woody and much thickened, convex, the seeds of each being unusually large and 3 cm. long. The pods of *O. crassivalvis* Gagnep. are larger (6–7 × 4.5 cm.) as compared with 6 × 2.8 cm. for *O. cambodiana* Gagnep. The seeds were described by Gagnepain in 1914 as "atro-purpureum, margine obtuso coccineo" and in 1920 as "luisante, acajou foncé, rouge carmin sur la pourtour." One seed from the type collection that we have seen conforms reasonably well to these descriptions except that the surface is partly black, but another has jet black shining seeds with no traces of red except the conspicuous red margins, which are from 2 to 5 mm. wide. The hilum is about 2 mm. long. The specimens that we have seen of *Ormosia cambodiana* Gagnep. lack the seeds, but these were described by Gagnepain as "atro-purpureum" and as "rouge-acajou." In both species the rachis is extended 1–1.8 cm. above the insertion of the upper pair of leaflets. In *Ormosia crassivalvis* Gagnep. the leaflets are merely blunt-

acuminate and more or less pubescent beneath, while in *O. cambodiana* Gagnep. they are slenderly and sharply caudate-acuminate and entirely glabrous.

7. **Ormosia cambodiana** Gagnep. Not. Syst. **3**: 29. 1914, et in Lecomte, Fl. Gén. Indo-Chine **2**: 513. 1920.

INDO-CHINA: Cambodia, Talung Mountain, near Kampot, *Pierre s.n.* (U, fragm. A), TYPE COLL.

Known only from the type collection; the species is discussed under the preceding one.

Series 5. SIMPLICIFOLIAE

8. **Ormosia simplicifolia** Merr. & Chun in herb. sp. nov.

Ormosia obscurinervia Merr. & Chun, ex Tanaka & Odashima, Jour. Soc. Trop. Agr. **10**: 369. 1938 (Contr. Hort. Inst. Taihoku Univ. **24**: 369), *nomen nudum.*

Arbor parva, ad 5 m. alta, glabra, ramis ramulisque teretibus, ramulis ultimis 1–1.5 mm. diametro; foliis semper simplicibus, chartaceis vel subcoriaceis, oblongis vel lanceolatis, plerumque graciliter acuminatis (saepe caudato-acuminatis), basi acutis vel subobtusis, 6–25 cm. longis, 2–6 cm. latis, in sicco pallidis vel pallide olivaceis, subtus pallidioribus, utrinque glaberrimis; nervis primariis utrinque 8–10, gracilibus, obscuris, curvatis, obscure arcuato-anastomosantibus, saepe obsoletis vel subobsoletis, reticulis obsoletis; petiolo 4–8 mm. longo, rugoso; inflorescentiis terminalibus vel in axillis superioribus, plerumque depauperato-paniculatis, interdum simpliciter racemosis, ramis primariis paucis, 4–6 cm. longis, circiter 10 cm. longis, obscure pubescentibus vel glabris; floribus roseis, graciliter pedicellatis, circiter 1.5 cm. longis, calycibus breviter consperse adpresse pubescentibus, tubo circiter 4 mm. longo, lobis oblongis, obtusis, circiter 6 mm. longis, 3.5–4 mm. latis, intus obscure pubescentibus vel subglabris; petalis circiter 15 mm. longis, vexillo late ovato, ad 15 mm. lato, apice leviter retuso, basi latissime truncato-rotundato, distincte bicalloso, unguiculo 2 mm. longo; alis carinisque inaequilateraliter oblongo-oblanceolatis, 5 mm. latis, apice rotundatis, basi haud auriculatis, unguiculis ad 4 mm. longis; staminibus 10, filamentis liberis, glabris, 8–15 mm. longis; ovario oblanceolato vel oblongo-lanceolato, 4-ovulato, glabro, stylo glabro, 6–7 mm. longo; leguminibus compressis, glabris, oblongo-ellipticis vel obovatis, 3–4.5 cm. longis, 2–2.5 cm. latis, dehiscentibus, valvis sublignosis, ad 2 mm. crassis, acutis, acuminatis, vel obtusis, basi plerumque acutis; seminibus 1–3, oblongo-ellipsoideis, rubris, duris, nitidis, in sicco plus minusve rugosis, interdum distincte viscosis; hilo 1.5 mm. longo.

INDO-CHINA: Tonkin, Taai Wong Mo Shan and vicinity, near Chuk-phai, Hai-coi, *W. T. Tsang 29144* (TYPE A), June 1–9, 1939, a fairly common shrub growing in thickets, moist clayey soil, flowers rose, fragrant; also from the same general locality, *W. T. Tsang 27255, 29112, 29341* (A); Pac-si, northeast of Mon-cay, *W. T. Tsang 26932* (A), Oct. 1–8, 1936; Sai Wong Mo Shan (Sai Vong Mo Leng), near the juncture of the Tonkin-Kwangtung-Kwangsi boundaries, *W. T. Tsang 29991, 30725* (A), Oct.–Nov. 1940. CHINA: Hainan, Po-ting, *F. C. How 72498, 72753* (A), May 20 and June 5, 1935, in forested ravines, alt. about 450 m., these with immature fruits.

This species is distinguished from all known representatives of the genus by its characteristic strictly simple leaves, all other described species now retained in *Ormosia* having pinnate leaves; yet in all essential characters it is strictly an *Ormosia* as that genus is at present interpreted. The mature seeds are frequently distinctly viscid when dry, a character we have otherwise observed in *Ormosia* only in the entirely different *O. xylocarpa* Chun. The Hainan form has leaves somewhat smaller than the Indo-Chinese plant and more stoutly acuminate, ranging from 6 to 12 by 2 to 4.5 cm. in size. The pods, as in many other species of the genus, vary considerably in shape and size, as well as in the number of seeds.

Series 6. Striatae

9. **Ormosia striata** Dunn, Jour. Linn. Soc. Bot. **35**: 492. 1903; Prain, Jour. As. Soc. Bengal **73**(2): 46. 1904; Lace & Rodger, List Trees Shrubs Burma 58. 1922 (err. *stricta*).

China: Yunnan, *Henry 11886* (A), *12843* (A, N), *12979* (A, N, U), *12979A* (A, U), *12979B* (A, N). Also Burma.

The listed numbers are iso-syntypes. The ovary is glabrous. The hard red shining seeds are about 12 mm. long and the hilum is 2 mm. in length. The species, when bearing fully mature pods, is curiously similar to *Ormosia pinnata* (Lour.) Merr., but its flowers are smaller, 1 cm. long, while the calyces are glabrous outside. When immature the pods are somewhat compressed, but when mature they are nearly cylindric, non-septate or only partly septate between the seeds when more than one-seeded. In *Ormosia pinnata* (Lour.) Merr. the ovaries and calyces are densely pubescent. This is the type of Prain's subsection *Striatae,* l.c.

Series 7. Pinnatae

10. **Ormosia pinnata** (Lour.) Merr. Lingnan Sci. Jour. **14**: 12. 1935, Trans. Am. Philos. Soc. II. **24**(2): 192. 1935.

Cynometra pinnata Lour. Fl. Cochinch. 268. 1790, ed. Willd. 329. 1793; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 155. 1913.

Ormosia hainanensis Gagnep. Not. Syst. **3**: 31. 1914, et in Lecomte, Fl. Gén. Indo-Chine **2**: 511. 1920; Merr. Philip. Jour. Sci. **15**: 240. 1919, Lingnan Sci. Jour. **5**: 91. 1928; Chun, Sci. Jour. Col. Sci. Sunyatsen Univ. **2**(3): 52. 1930; Hand.-Maz. Oesterr. Bot. Zeitschr. **80**: 342. 1931.

Indo-China: Annam, Tourane, *Clemens 4015* (A, N). China: Kwangtung, Kochow region, *CCC 2664* (*To & Fuson*) (N, L); Hainan, *Hongkong herb. 443* (A, U), *CCC 7718* (*McClure*) (A), *LU 15698, 16196* (*Tsang*) (A, N, L), *H. Fung 20371* (A, N), *C. I. Lei 91, 790* (N), *S. K. Lau 356, 1141* (A, N), *2652, 2836, 27283, 27443, 27641* (A), *N. K. Chun & C. L. Tso 43544* (N), *43848, 44088* (A, N), *C. L. Tso 70414* (N), *F. C. How & N. K. Chun 70128* (N), *70158, 70207* (A, N), *F. C. How 72995* (N), *C. Wang 32859* (A, N), *32902, 33738, 33946, 35487, 36458* (N), *H. Y. Liang 62042, 63327* (A, N), *63025 63230, 63336, 63338, 63470, 64621, 66329, 66571* (N), *Gressitt 1046* (A), *L. Tang 443* (A). A small tree in forests at Fan Yah, Sha Po Shan, Yaichow, and other localities, apparently common in Hainan.

Gagnepain, in Lecomte, Fl. Gén. Indo-Chine 2: 155. 1913, left Loureiro's species under *Cynometra,* stating: "Espèce très douteuse, appartenant peut-être à un autre genre." Merrill, Lingnan Sci. Jour. **14**: 12. 1935, Trans. Am. Philos. Soc. II. **24**(2): 191. 1935, discussed the species, and correctly, we believe, transferred it to *Ormosia,* making *O. hainanensis* Gagnep. a synonym. Loureiro's description of the fruit as "lunatum" is not good, although occasionally a 1-seeded pod does suggest this shape; this descriptive word was probably taken from the generic description of *Cynometra,* or added to make the species description conform to the characters of *Cynometra.* It should be noted, in reference to Loureiro's species, that the cited *Clemens* specimen, which clearly represents the same species as the Hainan form, came from the general vicinity of his place of residence in Annam, and in interpreting *Cynometra pinnata* Lour. it is significant that Loureiro described its seeds as "rubro." The pods vary greatly in size and somewhat in shape, being 1–4-seeded. Handel-Mazzetti described them in 1931, but Merrill's description of 1919 is better. Immature fruits are compressed and very slightly pubescent, but mature ones are almost terete, glabrous, ovoid and usually rostrate when 1-seeded, cylindric and merely apiculate when several-seeded, sometimes obscurely torulose between the seeds, 3–8 cm. long, 2–2.5 cm.

wide, and 2–2.5 cm. thick, the valves very woody, much thickened, septate between the seeds, pale or dark-brown, and more or less verruculose when dry; seeds 1–4, ellipsoid to oblong-ellipsoid, 1.5–1.8 cm. long, bright red when mature, the testa hard, usually wrinkled when dry, the hilum about 2 mm. long. In many respects this species resembles *Ormosia striata* Dunn, but its flowers are a third longer, and the calyces and ovaries are densely pubescent.

11. **Ormosia indurata** Chen, sp. nov.

Arbor parva, 5–9 m. alta, ramis in sicco atris, glabris, teretibus, ramulis junioribus glabris vel sursum obscure breviter pubescentibus; foliis pinnatis, 8–10 cm. longis, rhachi glabra, ultra jugum ultimum foliolorum breviter (1–5 mm.) producta, raro haud producta; foliolis 7–9, oblanceolatis vel late oblongo-oblanceolatis, 3.5–6 cm. longis, 7–20 mm. latis, breviter obtuse acuminatis, deorsum angustatis, basi cuneatis, margine leviter revolutis, utrinque glabris, supra pallide viridibus vel pallide olivaceis, subtus pallidioribus; nervis primariis utrinque 4–6, gracilibus, supra obscuris, subtus paullo elevatis, adscendentibus, venulis arcte reticulatis; petiolulis 4–5 mm. longis, rugosis, glabris vel obscurissime pubescentibus; paniculis terminalibus, erectis, immaturis circiter 5 cm. longis, cum alabastris obovoideis valde immaturis dense breviter adpresse subferrugineo-pubescentibus; ovario dense cinereo-pubescente, 4-ovulato; leguminibus ligneis, subturgidis, obovatis vel oblongis, 3.5–4.5 cm. longis, 2–2.5 cm. latis, valvis ligneis, incrassatis, extus subconvexis, breviter apiculatis, basi stipitatis, junioribus plus minusve breviter pubescentibus, maturis glabris vel subglabris; seminibus 1 vel 2, ellipsoideis, duris, nitidis, rubro-brunneis, levibus, leviter compressis, ad 1 cm. longis et 7 mm. latis, hilo 2 mm. longo.

China: Kwangtung, Lin Fa Shan, Sam Hang Shek T'au village, Hwei-yang District, *W. T. Tsang 25830* (type A), Sept. 12–30, 1935, a tree about 9 m. high, fairly common; Kwangsi, Shap Man Taai Shan, southeast of Shangsze, Shangsze District, on the Kwangtung border, *W. T. Tsang 22314* (A), a specimen with immature flower buds, the leaflets larger than in the holotype (5–6 × 2 cm. as compared with 3.5–5 × 0.7–1.5 cm.).

A species characterized by its small, oblanceolate to broadly oblanceolate leaflets and its turgid somewhat woody 1- or 2-seeded pods which at first are shortly pubescent, at maturity glabrous or nearly so, and its brownish red rather than bright red seeds.

Series 9. Pachypterae

12. **Ormosia pachyptera** Chen, sp. nov.

Arbor circiter 8 m. alta, subglabra (floribus ignotis), ramis ramulisque glabris incrassatis; foliis pinnatis, 25–27 cm. longis, rhachi glabra ultra jugum ultimum foliolorum brevissime (2–3 mm.) producta, glandulis minutis inter foliola jugi cujusvis insignita; foliolis 15–17, subcoriaceis, lanceolatis vel anguste oblongis, 5.5–8.5 cm. longis, 2–2.4 cm. latis, graciliter acuminatis, acuminibus acute apiculatis, basi acutis, supra olivaceis, glabris, haud nitidis, subtus subglaucis, minute consperseque breviter adpresse pubescentibus glabrescentibus; nervis primariis utrinque 5–7, gracilibus, subobscuris, curvato-adscendentibus, subtus paullo elevatis, obscure anastomosantibus; petiolulis 5 mm. longis, glabris, rugosis; inflorescentiis ut videtur paniculatis (floribus ignotis); leguminibus stipitatis, obovatis, compressis, apice latissime rotundatis, abrupte breviter crasseque acuminatis, deorsum angustatis, basi acutis, 6 cm. longis, 4.5 cm. latis, circiter 1 cm. crassis, 2-spermis, valvis atris, marginibus crassissime alatis, alis vel margine productis duris 5–15 mm. latis, deorsum angustatis, partibus seminiferis circiter 2.5 cm. latis; seminibus ellipsoideis, rubris, nitidis, duris, levibus, leviter compressis, circiter 1.5 cm. longis et 1 cm. latis, hilo 2.5 mm. longo.

China: Kwangsi, Chen Pien District, *S. P. Ko 55924* (type A), Oct. 17, 1935, a tree about 8 m. high on thinly forested slopes, altitude about 900 m.

This species is characterized by its numerous lanceolate or narrowly oblong, slenderly acuminate, and sharply apiculate leaflets, the rachis only slightly produced above the insertion of the upper pair of leaflets, and with a small but distinct gland on the upper surface of the rachis between each pair of petiolules, the latter a character that we have not observed in any other species of the genus. The obovate, compressed, indurated, glabrous pods are also very characteristic and are totally different from those of all the other known Chinese species in that the thickened edges of the valves extend quite around each valve as a wing-like projection from the seed-bearing parts, the latter being but 2.5 cm. wide, this extension varying from 5 to 15 mm. wide, gradually disappearing towards the acute base.

13. **Ormosia purpureiflora** Chen, sp. nov.

Frutex vel arbor parva, ramis glabris, ramulis obscure breviter pubescentibus; foliis pinnatis, circiter 20 cm. longis, rhachi ultra jugum ultimum foliolorum 8–10 mm. producta; foliolis 11–13, oblongis, 6–9.5 cm. longis, 2–2.5 cm. latis, acutis vel subobtusis, minutissime apiculatis, basi late acutis vel obtusis, subcoriaceis, in sicco supra olivaceis, glabris, costa valde impressa, subtus pallidis, obscure cinereo-pubescentibus, costa valde elevata; nervis primariis utrinque 5–8, subtus elevatis, curvato-adscendentibus, arcuato-anastomosantibus, venulis utrinque arcte reticulatis sed vix perspicuis; petiolulis glabris subglabrisve, rugosis, 5 mm. longis; inflorescentiis paniculatis, 12–20 cm. longis, consperse breviter subadpresse griseo-pubescentibus; floribus circiter 15 mm. longis, purpureis; calycibus lobis oblongo-ovatis, 3–4 mm. longis, 2.5–3 mm. latis, late acutis vel obtusis, extus consperse breviter adpresse pubescentibus, intus leviter cinereo-pubescentibus; vexillo orbiculari-ovato, circiter 1.5 cm. diametro, basi latissime truncato-rotundato haud calloso, unguiculo circiter 2 mm. longo; alis carinisque basi biauriculatis, carinis in marginibus exterioribus sursum leviter pubescentibus; staminibus 10, inaequalibus, filamentis 8–15 mm. longis, glabris, liberis; ovario sessili, oblongo, glabro, 6-ovulato; leguminibus ignotis.

China: Kwangtung, Naam Kwan Shan, Lung-men District, *W. T. Tsang 25362* (type A), June 1–9, 1935, fairly common, flowers purple, odorless.

Ormosia purpureiflora Chen and *O. pachyptera* Chen, although their types are not strictly comparable, one being in fruit and the other in flower, are apparently closely allied species, and because of the great similarities in the general appearance of the two specimens in their vegetative characters, we have placed *Ormosia purpureiflora* in the same series as *O. pachyptera*. The leaflet-tips of the two are distinctly different, while *Ormosia purpureiflora* has no glands on its leaf-rachis, the presence of a small but distinct gland on the upper surface of the rachis between the insertion of each pair of petiolules being one of the characters of *O. pachyptera*.

Series 9. Xylocarpae

14. **Ormosia xylocarpa** W. Y. Chun in herb. sp. nov.

Ormosia xylocarpa W. Y. Chun ex Tanaka & Odashima, Jour. Soc. Trop. Agr. **10**: 369. 1938 (Contr. Hort. Inst. Taihoku Univ. **24**: 369), *nomen nudum.*

Arbor 12–20 m. alta, ramis glabris, ramulis dense subadpresse breviterque subcinereo-pubescentibus; foliis pinnatis, circiter 15 cm. longis, rhachi breviter pubescente, ultra jugum ultimum foliolorum 5–15 mm. producta; foliolis 5–7, coriaceis, oblongis, late oblongo-oblanceolatis, vel ellipticis, 4–8 cm. longis, 1.5–3 cm. latis, obtusis vel breviter acuminatis, basi late acutis vel subcuneatis, supra pallidis vel olivaceis, glabris, subtus pallidioribus, minute puberulis, vetustioribus glabrescentibus; nervis primariis utrinque circiter 8, gracilibus, subtus paullo

elevatis, curvatis, obscure arcuato-anastomosantibus, venulis arcte reticulatis, vix perspicuis; petiolulis 7 mm. longis, glabris vel pubescentibus, rugosis; inflorescentiis ut videtur depauperato-paniculatis, quam foliis brevioribus, terminalibus (sub fructu tantum visis), breviter pubescentibus; floribus ignotis; leguminibus compressis, ligneis, obovatis vel ellipticis vel oblongo-ellipticis, rariter inaequilateraliter obovatis, 5–7 cm. longis, 3–3.5 cm. latis, ad 1.5 cm. crassis, apiculato-acuminatis, basi crasse stipitatis, extus dense subadpresse breviter subferrugineo-pubescentibus; seminibus 1–5, ellipsoideis vel ovoideo-ellipsoideis, rubris, nitidis, duris, levibus, circiter 12 mm. longis, integumentis saepe distincte viscidis; hilo 2.5 mm. longo.

China: Hainan, Mo Shan Leng, *Chun & Tso 44382A* (type A, isotype N), Nov. 25, 1932, a forest tree 20 m. high, altitude about 600 m., *C. Wang 34477* (A, N), Oct. 4, 1933, *H. Y. Liang 63399, 63623, 63673* (A, N), October and November, 1933, *C. Wang 35703* (N), December, 1933; Kwangsi, Shap Man Taai Shan, *W. T. Tsang 24427* (A), Oct. 1–16, 1934, leaflets smaller than in the type, the fruits smaller and the seeds brownish red.

This is a characteristic species, distinguished by its thick, flattened, pubescent pods, the valves much thickened. The fully mature seeds are often distinctly viscid, a character we have otherwise observed only in the entirely different *Ormosia simplicifolia* Merr. & Chun. This viscid character may be associated with certain stages of development, for the seeds of some of the specimens, although nearly mature, are not at all viscid.

15. **Ormosia polysperma** Chen, sp. nov.

Arbor 8–18 m. alta, ramis teretibus, glabris vel brevissime pubescentibus, ramulis consperse vel dense breviter pubescentibus; foliis pinnatis, 21–25 cm. longis, rhachi breviter pubescente, ultra jugum ultimum foliolorum longe (1.5–3 cm.) producta; foliolis 5–7, oblongis vel oblongo-ellipticis, 8–15 cm. longis, 2.5–5 cm. latis, coriaceis vel subcoriaceis, rigidis, brevissime subobtuse acuminatis, basi late acutis, supra pallidis vel pallide olivaceis, glabris, subtus pallidioribus, conspersissime breviter pubescentibus; nervis primariis utrinque 10–12, haud perspicuis, subtus paullo elevatis, subpatulis, leviter curvatis, obscure arcuato-anastomosantibus, venulis subtus leviter elevatis, subconferte reticulatis; petiolulis breviter pubescentibus, rugosis, 8–11 mm. longis; inflorescentiis terminalibus, paniculatis, 8–14 cm. longis, plerumque e basi ramosis, ramis primariis 6–8 cm. longis vel inflorescentiis in axillis superioribus racemosis, dense breviter adpresse pubescentibus, pilis aliis pallide brunneis aliis subnitidis; bracteis bracteolisque brevibus, pubescentibus; pedicellis ad 8 mm. longis, crassis; floribus albidis, magnis, calycibus circiter 2.5 cm. diametro (apertis), lobis oblongo-ovatis, subacutis, ad 10 mm. longis et 6 mm. latis, extus densissime breviter pubescentibus, intus subpilosis; petalis omnibus circiter 2 cm. longis, vexillo suborbiculari-obovato, retuso, basi latissime acuto, unguiculo circiter 2.5 mm. longo; carinis alisque longe (4–5 mm.) unguiculatis, basi cuneatis, 8–10 mm. latis, alis rotundatis, glabris, carinis obscure subfalcatis, subacutis, sursum in marginibus exterioribus plus minusve pubescentibus; filamentis glabris, inaequalibus, 1.4–2.2 cm. longis, liberis; ovario sessili, oblongo-lanceolato, densissime pubescente, stylis sursum curvatis, glabris, deorsum plus minusve pubescentibus, circiter 1.5 cm. longis; ovulis 7–9; leguminibus 1- vel 2-spermis, compressis, oblique ovatis, et 3 cm. longis, vel polyspermis, subfalcato-oblongis, et 7 cm. longis, 3 cm. latis, valvis extus dense subadpresse subferrugineo-pubescentibus, rostratis, induratis; seminibus usque ad 9, oblongo-ellipsoideis, immaturis rubro-brunneis, levibus, nitidis, duris, ad 1 cm. longis et 6 mm. latis, hilo 1.5 mm. longo.

China: Kwangsi, Na I, Lin Yuin Hsien, *Steward & Cheo 545* (type A, isotype N), May 30, 1933, shrub, hillside-forest, flowers white; *Z. S. Chung 83379* (A); Kwangtung, Lung Tau Shan, Iu, *CCC 12506, 12643* (*To & Tsang*) (N), May 29, 1924; Yam Na Shan,

Mei District, *W. T. Tsang 21484, 21884* (N), Aug. 4–31, 1932; Hau T'ong Shan, Sin-fung District, *Y. W. Taam 880* (A), June 1–19, 1938; Sha Lo Shan, Sin-fung District, *Y. W. Taam 1040* (A), July 6–25, 1938; Kiangsi, Sai Hung Cheung, near Tung Tei Village, Kiennan District, *S. K. Lau 4343* (A), Sept. 1–11, 1934, rare, in forest; Tai Au Hong, *Gressitt 1610* (A), July 7, 1936.

This species is manifestly very closely allied to *Ormosia xylocarpa* Chun, the type of the latter being from Hainan, differing in its usually much larger leaflets. Unfortunately all of our Hainan material representing Chun's species is in fruit, while most of the Kwangsi, Kiangsi, and Kwangtung specimens which we place under *O. polysperma* Chen are in flower, none of the fruiting specimens having fully mature pods. It is entirely possible that future collections may show that it is undesirable to attempt to maintain two species here.

Series 10. Sericeolucidae

16. **Ormosia sericeolucida** Chen, sp. nov.

Arbor 24 m. alta, ramis ramulisque velutino-tomentellis; foliis pinnatis, 16–20 cm. longis, rhachi subcinereo-pubescente, ultra jugum ultimum foliolorum 5–10 mm. producta; foliolis 5–7, coriaceis, late oblongo-oblanceolatis vel oblongo-ellipticis, 8–11 cm. longis, 3–4.5 cm. latis, acutis vel leviter acuminatis, saepe brevissime mucronatis, basi acutis, margine subrevolutis, supra olivaceis, nitidis, glabris, costa valde impressa, subtus pallidis, densissime breviter subadpresse pubescentibus, indumento nitido; nervis primariis utrinque 10–12, supra obscuris, subtus distinctioribus, paullo elevatis, ad marginem arcuato-anastomosantibus, reticulationibus utrinque obsoletis vel subobsoletis; petiolulis 8–10 mm. longis, crassis, densissime breviter pubescentibus; inflorescentiis (sub fructu) paniculatis, terminalibus, breviter ramosis, densissime breviter pubescentibus; calycibus persistentibus circiter 1 cm. diametro, extus dense uniformiter pubescentibus; leguminibus immaturis stipitatis, compressis, oblongo-ellipticis vel obovatis, interdum plus minusve inaequilateralibus, 3–5 cm. longis, 2.2 cm. latis, apice rotundatis vel inaequilateraliter brevissime late acuminatis, extus densissime breviter subochraceo-pubescentibus, valvis crustaceo-coriaceis, vix 1 mm. crassis; seminibus solitariis vel binis, valde immaturis brunneis, compressis, duris, irregulariter obovatis vel oblongo-obovatis, saltem 1 cm. longis (maturis ignotis), hilo minuto.

China: Kwangsi, Seh-feng Dar Shan, south of Nanning, *R. C. Ching 7931* (type A, isotype U), Oct. 16, 1928, a rare tree 24 m. high in forests, altitude about 360 m.

This species is distinguished by the pale brownish, very dense, and often shining pubescence on the lower surface of the leaflets, the panicles, and the fruits. It is suspected that the mature seeds will prove to be red and considerably larger than indicated in this description, based on the very immature ones at present available.

Series 11. Layia

(*Layia* Hook. & Arn., as a genus; subsect. *Layia* of Sect. *Ormosia* proper Prain, of the subgenus *Toulichiba*)

17. **Ormosia emarginata** (Hook. & Arn.) Benth. Hook. Jour. Bot. Kew Gard. Miscel. **4**: 77. 1852; Benth. Fl. Hongk. 96. 1861; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 204. 1890; Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Not. Pap. 390. 1901); Dunn & Tutch. Kew Bull. Add. Ser. **10**: 88. 1912; Chun, Sci. Jour. Col. Sci. Sunyatsen Univ. **2**(3): 48. 1930; Merr. Lingnan Sci. Jour. **14**: 12. 1935.

Layia emarginata Hook. & Arn. Bot. Beechey Voy. 183. *t. 38*. 1833.

Macrotropis emarginata Walp. Rep. **2**: 903. 1843.

Ormosia glaberrima Wu, Bot. Jahrb. **71**: 182. 1940.

China: Hongkong (and Hongkong New Territory), *C. Wright s.n.* (G, N, U), *Ford. s.n.* (A), *Hance 705* (G), *Hongkong Herb. 7496* (A), *11223* (N), *W. Y. Chun 6006, 6900* (A, N), *Y. Tsiang 35* (A); Hainan, Yeung Lam Shan, Yai-hsien District, *S. K. Lau 226, 6135* (A), July 1932 and May, 1935; Po-ting, *F. C. How 72920* (A), June 16, 1935; also Kwangtung and Kwangsi, fide Wu. Indo-China: Tonkin, Sai Wong Mo Shan (Sai Vong Mo Leng), Dam-ha, immediately south of the juncture of the Kwangtung-Kwangsi-Tonkin boundaries, *W. T. Tsang 30082, 30185* (A), May–Sept., 1940, in flower and with immature fruits.

This species is strongly characterized by its small flowers, most parts being glabrous except the cinereous-pubescent inner parts of the calyces, the calyces being characteristically black when dry in sharp contrast to the pale petals. The leaflets are always retuse and vary in number from 3 to 7, being mostly 5 to 7. The small, hard, smooth, shining, scarlet, ovoid to ellipsoid seeds are up to 1 cm. long and the hilum is about 2 mm. long. *Ormosia glaberrima* Wu, Bot. Jahrb. 71: 182. 1940, was based on three collections from Kwangsi and Kwangtung, *Sin 5224, 21512, 22390,* and regarding it Wu says: "Species habitu toto glaberrimo, necnon leguminibus *O. emarginatae* Benth. affinis, sed ab ea foliolis floribusque diversa." We have seen none of the cited specimens, but from a critical study of the detailed description we are not able to separate this from *Ormosia emarginata* Benth., a species represented in our herbarium by ample material in various stages of development. We suspect that the form Wu had is actually represented by *Tsang 30082* and *30185* from the extreme northeastern limits of Tonkin, just below the juncture of the Kwangsi-Kwangtung-Tonkin boundaries.

18. **Ormosia kwangsiensis** Chen, sp. nov.

Frutex vel arbor parva, ramis glabris, ramulis ultimis glabris vel obscure pubescentibus; foliis pinnatis, 15–19 cm. longis, rhachi glabra, ultra jugum ultimum foliolorum haud vel ad 1 cm. producta; foliolis vulgo 7, subcoriaceis, glaberrimis, oblongis, in sicco supra brunneo-olivaceis, nitidis, subtus brunneis, breviter subobtuse acuminatis, basi late acutis vel rotundatis, 7–9 cm. longis, 2.5–3 cm. latis; nervis primariis utrinque 8 vel 9, gracilibus, subtus leviter elevatis, obscure arcuato-anastomosantibus, reticulationibus sublaxis; petiolulis rugosis, glabris, castaneis vel glaucis, 7 mm. longis; paniculis (sub fructu) obscurissime castaneo-hirsutis glabrescentibus, floribus ignotis; leguminibus compressis, haud stipitatis vel brevissime stipitatis, apice breviter acuminatis, oblongo-obovoideis vel oblongo-ellipticis, glabris, compressis, maturis atris, utrinque late acutis, 3.3–4.5 cm. longis, 2 cm. latis, valvis subnitidis, crustaceo-coriaceis vel sublignosis, ca. 1 mm. crassis; seminibus 1 vel 2, ellipticis, rubris, duris, nitidis, compressis, circiter 1 cm. longis, hilo elliptico, 1 mm. longo.

China: Kwangsi, Shap Man Taai Shan, Tang Lung village, southeast of Shangsze, Shangsze District on the Kwangtung border, *W. T. Tsang 24147* (type A, NA, N), Aug. 30, 1934, fairly common in thickets; Seh-feng Dar Shan, south of Nanning, *R. C. Ching 8301* (N), Oct. 28, 1938.

In vegetative characters this species somewhat suggests *Ormosia semicastrata* Hance, but, because of its very differently shaped and much longer 1- and 2-seeded pods, it clearly does not belong in the alliance of that species; when the flowers are known it will probably be found to have ten stamens rather than five as Hance's species. This is another of the several species that discredits the rachis character as a dependable one by which subdivisions such as *Chaenolobium* and *Ormosia* proper may be distinguished. In the type collection, the rachises of some leaves are not at all produced, while in others they are up to 8 mm. in length above the insertion of the upper pair of leaflets; in *Ching 8301* they are all produced about 1 cm.

19. **Ormosia Henryi** Prain, Jour. As. Soc. Beng. **69**(2): 180. 1900 (Bot. Not. Pap. 310. 1901); Craib in Sargent, Pl. Wils. **2**: 93. 1914; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 511. 1920; Hu, Contr. Biol. Lab. Sci. Soc. China **2**(5): 9. 1926; Chun, Sci. Jour. Coll. Sci. Sunyatsen Univ. **2**(3): 46. 1930; Merr. & Chun, Sunyatsenia **1**: 60. 1930; Hand.-Maz. Beih. Bot. Centralbl. **52B**: 157. 1934.

Ormosia Henryi Hemsl. & Wils. Kew Bull. **1906**: 156. 1906; Chun, Chinese Econ. Trees 187. 1922.

Ormosia mollis Dunn, Jour. Bot. **47**: 198. 1909; Dunn & Tutch. Kew Bull. Add. Ser. **10**: 88. 1912.

China: Chekiang, *R. C. Ching 1709, 2482* (A, U), *2214* (A, N, U); *Y. L. Keng 320* (A); Anhwei, *R. C. Ching 3188* (A); Fukien, *H. H. Chung 967* (A), *6817* (A, L), *7829* (A, N, L); *Metcalf 7438* (A); Kwangtung, *CCC (Levine) 3456* (A, G), *1112* (A, G, N, U, L); *CCC 14265 (Tsang & Wang)* (L); *Y. Tsiang 3323* (N); *N. K. Chun 40347* (N); *Y. F. Chun 30384* (N); Kwangsi, *R. C. Ching 5279* (A, N, U); *W. T. Tsang 27965* (A); *Z. S. Chung 83405* (A); Kweichow, *Y. Tsiang 7754* (A, N); Hunan, *Handel-Mazzetti 11482 (482 = 2291)* (A); Hupeh, *Henry 7577* (isotype G, U); *Wilson 2373* (A, G, U); *H. C. Chow 1878* (A, N); Kiangsi, *H. H. Hu 1298* (A); *Y. Tsiang 10229, 10276* (N); *S. K. Lau 3968* (A). Also Tonkin, *fide* Gagnepain.

Prain's description of this species, based on *Henry 7577,* has six years' priority over the identical binomial published by Hemsley & Wilson in 1906, the latter also based in part on the same collection. Dunn, in describing *O. mollis* in 1909, based this in part on *Ford 60,* which Hemsley & Wilson cited as representing *O. Henryi* Hemsl. & Wils. There is no doubt as to the specific identity of the three independently described species, a fact that Merrill and Chun have already noted.

Ormosia Henryi Prain is marked by the tawny to pale, soft indumentum of the branches, branchlets, the lower surface of the leaflets, the petioles, the inflorescences, and the flower-buds. The leaflets are large, elliptic to oblong or lanceolate, and firmly coriaceous. The strongly compressed pods are glabrous or nearly so and vary a great deal in size and in the number of seeds. In pods on one Kwangsi specimen the seeds vary from one to seven; one Hupeh specimen that we refer here has as many as ten seeds, its pods being up to 12 cm. long and 3.5 cm. wide. In the other fruiting specimens cited the pods are smaller, varying from 4 to 9 cm. long and 2 to 2.5 cm. wide, but in these the seeds vary in number from one to as many as nine, one- or few- to many-seeded pods occurring on the same specimen. The hard, red, shiny, smooth seeds are mostly 9–12 mm. long (8–15 mm. according to Hemsley & Wilson), and the hilum is 2.5–3 mm. in length.

20. **Ormosia formosana** Kaneh. Bot. Mag. Tokyo **30**: 420. 1916, Formos. Trees 205. *1 f.* 1917, ed. 2. 205. *1 f.* 1918, ed. 3. 305. *f. 260.* 1936; Hayata, Ic. Pl. Formos. **10**: 5. 1921; Yamamoto, Suppl. Ic. Pl. Formos. **2**: 26. *f. 16.* 1926.

Formosa: Nanto, *Wilson 9994* (A); Rengachi, *Hayashi 306, 21255* (A); Baran, *Kudo* (A).

The red hard shining seeds are about 1 cm. long, the hilum 2 mm. in length. The rachis is produced 5 to 15 mm. above the point of insertion of the upper pair of leaflets. On the cited specimens the leaflets vary from 3 to 5, but Kanehira states that they vary from 5 to 9. Yamamoto thought that the species was very close to *Ormosia Fordiana* Oliv., but the two are not related. *Ormosia formosana* is the only representative of the genus recorded from Formosa and is confined to that island.

21. **Ormosia microphylla** Merrill in herb. sp. nov.

Frutex circiter 3 m. altus, ramis teretibus, glabris vel subglabris, ramulis dense breviter subferrugineo-pubescentibus; foliis pinnatis, 12–16 cm. longis, rhachi

tenui, pilosa, ultra jugum ultimum foliolorum 5–7 mm. producta; foliolis plerumque 15, chartaceis, oblongis, 2–4 cm. longis, 1–1.5 cm. latis, acutis vel breviter acuminatis, basi rotundatis, supra olivaceis, glabris vel subglabris, subtus pallidis, plus minusve adpresse breviter pubescentibus; nervis primariis utrinque 5–7, gracilibus, subtus elevatis, distinctis, curvatis, ad marginem obscure curvato-anastomosantibus, reticulis gracilibus; inflorescentiis terminalibus (floribus ignotis); leguminibus stipitatis, subrhomboideis vel oblongis, 5–6 cm. longis, 2–3 cm. latis, compressis, breviter apiculatis, glabris, lucidis, in sicco atro-brunneis vel atris, valvis crasse coriaceis vel lignosis; seminibus 3 vel 4 (submaturis), brunneis, duris, subnitidis, 1.2 cm. longis, 0.6–0.8 mm. latis, hilo 3–3.5 mm. longo.

China: Kwangsi, Shap Man Taai Shan, near Hok Lung village, southeast of Shangsze, Shangsze District, near the Kwangtung border, *W. T. Tsang 22423* (type A), June 4, 1933, a shrub, fairly common in thickets; local name *so tau muk shue*.

The striking character of this species is its unusually small, numerous leaflets.

22. **Ormosia olivacea** Chen, sp. nov.

Arbor circiter 20 m. alta, ramis (8 mm. crassis) consperse subhirsutis, glabrescentibus, alabastris axillaribus densissime subferrugineo-pubescentibus; foliis pinnatis, circiter 45 cm. longis, petiolo et rhachi perspicue pubescentibus, rhachi ultra jugum ultimum foliolorum brevissime (2 mm.) producta; foliolis 17, oblongis, chartaceis vel membranaceo-subchartaceis, 12–15 cm. longis, 4–5 cm. latis, subacutis, obtusis, vel breviter obtuse acuminatis, basi rotundatis, supra glabris vel subglabris, levibus, costa valde impressa, subtus pallidioribus, consperse subpilosis; nervis primariis utrinque 6–8, subtus elevatis, perspicuis, curvatis, arcuato-anastomosantibus, supra plus minusve obscuris; petiolulis 4–5 mm. longis, crassis, subdense pubescentibus; inflorescentiis ignotis; leguminibus compressis, oblongis, glabris, circiter 7 cm. longis, 2.5 cm. latis, valvis coriaceis, circiter 1 mm. crassis, vetustioribus nigris; seminibus ad 4, obovoideis vel subreniformibus, circiter 9 mm. longis et 10 mm. latis, leviter compressis, duris, rubris, levibus, nitidis, hilo circiter 3 mm. longo.

China: Yunnan, Fo-Hai, *C. W. Wang 77291* (type A), July, 1936, a large tree in forests, about 20 m. high, the trunk 1 m. in diameter.

Of this we have a portion of a branch with one attached leaf and several pods or parts of pods apparently picked up from the ground under the tree; these fruits are very old, the valves having commenced to disintegrate. The species has no very close allies among the described forms and is characterized by its unusually long leaves and its large thin leaflets. The seeds are characteristically somewhat wider than long.

Series 12. Amacrotropis

(*Macrotropis* § *Amacrotropis* Miq. = subsect. *Amacrotropis* Prain of Sect. *Ormosia* proper Prain)

23. **Ormosia yunnanensis** Prain, Jour. As. Soc. Beng. **69**(2): 183. 1900 (Bot. Notes Pap. 393. 1901), **73**(2): 46. 1904; Craib, Fl. Siam. Enum. **1**: 497. 1928; Chun in Sci. Jour. Coll. Sci. Sun Yatsen Univ. 2(3): 45. 1930.

Ormosia microsperma sensu Chun, Sci. Jour. Sun Yatsen Univ. 2(3): 45. 1930, non Baker.

China: Yunnan, *Henry 11967*, isotype (A, N), *12885* (A, N, U), *C. W. Wang 75758, 71801, 78944* (A), *M. K. Li 1669* (A). Also Siam, *fide* Craib.

The type of *Ormosia microsperma* Baker was from Malacca. Chinese material so named which we have seen represents *O. yunnanensis* Prain. We think it certain that erroneously named material was the basis of Chun's record of the occurrence of Baker's species in Kwangtung. We have seen no Chinese material that conforms to the characters of *Ormosia microsperma* Baker and no

Kwangtung material that represents *Ormosia yunnanensis* Prain. The latter is characterized by its pyriform to suborbicular or ovate pods (if with but a single seed), or oblong pods (if with two seeds), which are glabrous except at the base and along one suture, and black when mature. The very hard, smooth, shining, bright red seeds are 8–10 mm. long, the hilum about 2 mm. in length. The leaflets are lanceolate, with short acute apices and rounded bases, and are conspicuously pubescent on the lower surface. This species was placed by Prain in his subsection *Amacrotropis* of *Ormosia* proper.

Series 13. Semicastratae

24. **Ormosia semicastrata** Hance, Jour. Bot. **20**: 78. 1882; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 204. 1887; Prain, Jour. As. Soc. Bengal **69**(2): 180. 1900 (Bot. Notes Pap. 390. 1901); Dunn & Tutch. Kew Bull. Add. Ser. **10**: 88. 1912; Merr. Lingnan Sci. Jour. **5**: 91. 1928; Chun, Sci. Jour. Col. Sci. Sun Yatsen Univ. **2**(3): 50. 1930.

China: Hongkong, Happy Valley, *Ford s.n.* (G,[1] N, photo. of holotype, A); Kwangtung, Hueng Lok Leuk, *CCC 13270* (*McClure*) (A, L); Ting Wu Shan, *W. Y. Chun 6478* (A), *Y. Tsiang 755* (A); Sha Po Shan, *Y. W. Taam 212* (A); Ying-tak, *K. K. Wang 2900* (A, N), *H. T. Ho 60020* (N); Hainan, Five Finger Mountains, Yaichow, Dung Ka, and Lokwui, *CCC 9809* (*McClure*) (A, N), *F. C. How 70309* (A, N), *F. C. How & N. K. Chun 70150* (A, N), *C. Wang 33625* (A, N), *33434, 35899* (N), *H. Y. Liang 62010, 64198, 65101* (N), *62561, 63111, 63487, 64382* (A, N), *S. K. Lau 28379* (A, N), *Chun & Tso 43490* (A, N); Kwangsi, Yung Hsien, *Steward & Cheo 835* (A, N).

This species is strongly differentiated by having but five fertile stamens and by its small, strictly 1-seeded fruits, among other characters. On its stamen characters alone it might be taken out of *Ormosia* as representing a distinct genus, but in its vegetative, pod, and seed characters it, like the other species placed in this series, is an *Ormosia* in all respects. The cited specimens show considerable variation in vegetative characters and some in indumentum. The Hongkong form, as represented by our material and as described by Hance, has but 3 or 5 leaflets and the rachis is produced 1.5 to 2.4 cm. above the point of insertion of the upper pair of leaflets. In the Kwangtung, Kwangsi, and Hainan material the leaflets are mostly 7 to 9, and the leaf-rachis above the point of insertion of the upper pair of leaflets is much shorter, usually not more than 1 cm. in length, frequently only a few mm., and occasionaly not produced at all. The hard smooth shining red seeds are 8–9 mm. in diameter, usually slightly wider than long, as is true of the seeds of the other species we have placed in this series. The small hilum is about 1.5 mm. long. While Hance correctly noted the five fertile stamens, he did not mention that the flowers, even those of his type collection, also have from two to four slender staminodes or sterile filaments 1 to 2 mm. in length.

25. **Ormosia apiculata** Chen, sp. nov.

Arbor circiter 19 m. alta, inflorescentiis (sub fructu) leviter pubescentibus exceptis glabra (floribus ignotis), ramis ramulisque teretibus; foliis pinnatis, 14–19 cm. longis, rhachi glabra, ultra jugum ultimum foliolorum longe (2–2.5 cm.) producta; foliolis 3–5, subcoriaceis, oblongis vel late oblongo-lanceolatis, 8–13 cm. longis, 2.5–3.5 cm. latis, utrinque subaequaliter angustatis, apice gradatim obscure acuminatis (acuminibus obtusis vel obscure emarginatis), basi acutis, supra pallide olivaceis, subopacis, subtus pallidioribus, costa supra impressa, subtus valde elevata; nervis primariis utrinque circiter 10, supra obscuris, subtus leviter elevatis, gracilibus, arcuato-anastomosantibus, reticulis leviter elevatis;

[1] This is an isotype, being labelled "Happy Valley woods, April, 1879," distributed as "*Ormosia* ? sp nov."

petiolulis 5–7 mm. longis, rugosis; paniculis terminalibus, sub fructu ad 20 cm. longis, e basi ramosis, ramis paucis, 5–15 cm. longis, partibus junioribus plus minusve subadpresse pubescentibus; leguminibus distincte stipitatis (stipite 2.5–4.5 mm. longo), late orbicularibus vel plerumque latioribus quam longis, 1.5 cm. longis, ad 2 cm. latis, compressis, glabris vel conspersissime breviter adpresse pubescentibus, basi late truncato-rotundatis, apice late rotundatis, abrupte graciliter apiculatis, apiculo 4–6 mm. longo, curvato, acuminato, valvis coriaceis, haud 1 mm. crassis; seminibus solitariis, immaturis compressis, rubris, duris, 10 mm. longis, hilo vix 1 mm. longo.

China: Kwangsi, Yeo Mar Shan, north of Hin Yen, *R. C. Ching 7183* (type A, isotype N), August 27, 1928, a rare tree in forests, alt. about 1650 m.

Although the flowers of this species are unknown, we place it with confidence in the group with *Ormosia semicastrata* Hance, because of its small, compressed, strictly 1-seeded pods, these (not fully mature) being much more compressed than in Hance's species, somewhat inequilateral, wider than long, and with a prominent curved apiculus 4 to 6 mm. in length.

26. **Ormosia cathayensis** Chen, sp. nov.

Arbor parva, 9–10 m. alta, ramis ramulisque glabris; foliis pinnatis, 15–21 cm. longis, rhachi breviter pubescente, ultra jugum ultimum foliolorum 1.2–2 cm. producta; foliolis 3–5, subcoriaceis, oblongis vel late oblongo-lanceolatis vel oblongo-ellipticis, 6–13 cm. longis, 3–4.5 cm. latis, plerumque distincte sed obtuse acuminatis (acuminibus plerumque minute emarginatis), raro obtusis, basi late acutis vel subrotundatis, supra olivaceis, glabris, costa valde impressa, subtus pallide brunneis, glabris vel secus costam sparsissime pubescentibus; nervis primariis utrinque circiter 10, gracilibus, subtus leviter elevatis, venulis arcte reticulatis; petiolulis rugosis, 6–10 mm. longis, obscure breviter pubescentibus; inflorescentiis (sub fructu) terminalibus, paniculatis, 11–15 cm. longis, ramis primariis paucis, ad 6 cm. longis, dense breviter subferrugineo-pubescentibus; calycibus persistentibus circiter 3 mm. longis, extus adpresse pubescentibus; floribus ignotis; leguminibus distincte inaequilateralibus, inflatis, circiter 1.5 cm. longis et 1 cm. latis, breviter stipitatis, basi subrotundatis, apice breviter (1–2 mm.) apiculatis, valvis coriaceis, atris, praesertim basi margineque plus minusve consperse pilosis glabrescentibus; seminibus solitariis, duris, levibus, rubris, nitidis, suborbicularibus vel obscure late obovatis, circiter 9 mm. longis, hilo 1 mm. longo.

China: Kwangtung, Kwai Shan, Tsing-lo-kong village, Ho-yuen District, *W. T. Tsang 28518* (A type), March 16–31, 1938, a fairly common tree in forests; Lung Tau Mountain, near Iu, *CCC 12257* (*To, Tsang & Tsang*) (U), May 29, 1924.

This species we also place with confidence in the group with *Ormosia semicastrata* Hance, although its flowers are unknown. It differs particularly in its distinctly inequilateral pods. A Kiangsi specimen, *Lau 3988* (A), is very similar to this, but its immature pods are strongly compressed, more equilateral, and very shortly apiculate.

27. **Ormosia Howii** Merrill & Chun in herb. sp. nov.

Arbor circiter 10 m. alta, ramis glabris, ramulis ultimis dense breviter pubescentibus, teretibus vel subangulatis; foliis pinnatis, 16–22 cm. longis, petiolo glabro vel breviter pubescente, rhachi ultra jugum ultimum foliolorum 3–8 mm. producta leviter pubescente; foliolis 5–7, crasse coriaceis, oblongo-ellipticis vel anguste oblongo-obovatis, 6–14 cm. longis, 2–4 cm. latis, obtusis vel obtuse acuminatis (acuminibus plerumque minute retusis), basi acutis vel subrotundatis, supra pallide viridibus, glabris, subnitidis, subtus pallidis vel pallide brunneis, glabris vel ad costam leviter pubescentibus, nervis primariis utrinque circiter 10,

supra subdistinctis, leviter impressis, subtus distinctioribus, leviter elevatis, arcuato-anastomosantibus, reticulationibus primariis distinctis, ultimis subdensis, omnibus leviter elevatis; petiolulis breviter pubescentibus, 5–8 mm. longis; paniculis terminalibus, sub fructu 15 cm. longis, dense subcinereo-pubescentibus vel ramulis ultimis ferrugineo-pubescentibus, ramis primariis ad 10 cm. longis; leguminibus 1-spermis, inaequilateraliter elliptico-ovatis vel ovato-rhomboideis, basi subinaequilateraliter rotundatis compressis, 2 cm. longis, 1.5–1.8 cm. latis, breviter stipitatis, valvis subabrupte acuminatis acuminibus 3–4 mm. longis, crasse coriaceis vel sublignosis, glabris vel (praesertim secus basim marginemque) conspersissime pilosis; seminibus leviter compressis, duris, nitidis, levibus, coccineis, suborbicularibus, circiter 8 mm. longis et 9 mm. latis; calycibus persistentibus ferrugineo-pubescentibus, circiter 4 mm. longis.

China: Hainan, Po-ting, *F. C. How 72892, 73646* (type A), June 14 and September 7, 1935, in forests, altitude 500 to 900 m.

This seems clearly to be very closely allied to *Ormosia semicastrata* Hance, but it differs so much in its vegetative and fruit characters that it seems desirable to recognize it, at least for the present, as a distinct species.

28. **Ormosia nanningensis** Chen, sp. nov.

Arbor 20 m. alta, ramulis glabris; foliis pinnatis, 13–20 cm. longis, rhachi glabra ultra jugum ultimum foliolorum circiter 1.5 cm. producta; foliolis plerumque 5, subcoriaceis, 7.5–11 cm. longis, 2.5–3.5 cm. latis, oblongis vel late oblongo-oblanceolatis, obtuse acuminatis, apice interdum minute emarginatis, basi late acutis, utrinque glaberrimis, supra subolivaceis, nitidis, subtus paullo pallidioribus; nervis primariis utrinsecus circiter 9, gracilibus, utrinque leviter elevatis, subdistinctis, distincte arcuato-anastomosantibus, reticulationibus sublaxis; petiolulis gracilibus, 8–10 mm. longis; inflorescentiis (sub fructu) circiter 15 cm. longis, griseo-pubescentibus, pedicellis 5 mm. longis, floribus ignotis; leguminibus compressis, ovatis, subaequilateralibus, 2 cm. longis, 1.8 cm. latis, breviter acuminatis, extus subdense breviter subgriseo-pubescentibus, monospermis, valvis coriaceis, haud 1 mm. crassis; seminibus solitariis, late subobovoideis, circiter 10 mm. longis et 9 mm. latis, leviter compressis, duris, nitidis, rubris, levibus; hilo circiter 3 mm. longo.

China: Kwangsi, Seh-feng Far Shan, south of Nanning, *R. C. Ching 8300* (type N, isotype L, frustulum A), Oct. 28, 1928, a rare tree in open woods, alt. about 650 m.

Although the flowers of this species are unknown, and although it differs from the others we have placed in the series *Semicastratae* particularly in its uniformly pubescent pods (those of the other species being glabrous or nearly so), we think that this species is correctly placed.

Series 14. Hosieae

29. **Ormosia Hosiei** Hemsl. & Wils. Kew Bull. **1906**: 156. 1906; Craib in Sargent, Pl. Wils. **2**: 94. 1914; Chun, Chinese Econ. Trees 187. 1922, Sci. Jour. Col. Sci. Sun Yatsen Univ. 2(3): 45. 1930.

Ormosia Taiana Chiao, Sinensia **3**: 349. 1933.

China: Hupeh, Nanto, *Wilson 808* (A, N), *1944* (K, syntype); Szechuan, Chengtu, *Wilson 3407* (A), *2372* (A, G, N), *S. S. Chien 5001* (A); Shensi, *H. W. Kung 3297* (A); Kiangsu, *F. L. Tai 1* (A, N), isotype of *Ormosia Taiana* Chiao.

This species seems to be a reasonably uniform one, and among all but one other Chinese species it is distinguished by its long hilum, which is 7 mm. in length; in all of the other Chinese species (except *O. Balansae* Drake) the hilum is 1 to 3 or at most 3.5 mm. in length. The only Old World species known to us with a longer hilum is the entirely different *Ormosia Balansae* Drake, in which the hilum is about 15 mm. long and extends halfway around the seed.

The tree is apparently not uncommon in cultivation; in fact the majority of the specimens cited above were taken from planted trees. The timber is highly valued in China, the tree being known as *hung tau shu* (red bean tree); see Wilson's note in Sargent, Pl. Wils. 2: 94. 1914. This species grows farther north in China than do any of the other known species of the genus. It is clearly not native of Kiangsu, as the cited specimen from that province was taken from a planted tree; the same statement is probably true as to the Shensi record, as the cited specimen was taken from a tree in temple grounds.

Series 15. Balansae

30. **Ormosia Balansae** Drake, Jour. de Bot. 5: 215. 1891; Prain, Jour. As. Soc. Bengal 69(2): 182. 1900 (Bot. Not. Pap. 392. 1901); Gagnep. in Lecomte, Fl. Gén. Indo-Chine 2: 512. 1920.

Ormosia elliptilimba Merr. & Chun, Sunyatsenia 2: 31. *t. 13.* 1934.

Indo-China: Tonkin, Tu-Phap, *Balansa 2178,* fragment of the type (A); Phu-Ho, *Pételot 3055, col. Du Pasquier* (A, N); Ho Yung Shan and Sai Wong Mo Shan (Sai Vong Mo Leng), south of the juncture of the Kwangsi-Kwangtung-Tonkin boundaries, *W. T. Tsang 30261, 30686* (A), July–November, 1940. China: Kwangsi, Sup-man-ta Shan, *H. Y. Liang 69829* (A); Hainan, Po-ting, Lingshui, Dung-Ka, Wen Fa Shi, and Yaochow, *S. P. Ko 52184* (A, N), type and isotype of *Ormosia elliptilimba* Merr. & Chun, *N. K. Chun & C. L. Tso 43772, 44286* (A, N), *C. Wang 33316, 33327* (A, N), *H. Y. Liang 62303, 64188* (N), *62302, 63773* (A, N), *F. C. How 72935, 73170, 73366* (A), *S. K. Lau 28015* (A).

This is one of the most strongly marked species in the genus and is easily distinguished from all other described forms by its very long and conspicuous hilum. The densely pubescent pods are mostly 1-seeded, sometimes 2-seeded, compressed, ovoid to suborbicular, tardily dehiscent (perhaps even indehiscent), the crustaceous valves being rather fragile. The shining red seeds are up to 14 mm. long, the very prominent hilum varying from 12 to 15 mm. in length; in this one character the species approaches the Brazilian *Macroule Coutinhoi* (Ducke) Pierce (*Ormosia Coutinhoi* Ducke). As noted under *Ormosia Hosiei* Hemsl. & Wils., all other Old World species known to us have a small hilum, 1 to 3 or at most 3.5 mm. long, except these two otherwise not at all closely allied ones. Merrill and Chun noted that their *Ormosia elliptilimba* was allied to *O. Balansae* Drake, listing minor differences; with access to type material and additional collections we find no possible way of distinguishing two species here, and so reduce *Ormosia elliptilimba* Merr. & Chun to synonymy.

Species of which the fruits are as yet unknown and which cannot now be placed in any proposed subdivision of the genus

31. **Ormosia euphorioides** Pierre ex Gagnep. Not. Syst. 3: 30. 1914, et in Lecomte, Fl. Gén. Indo-Chine 2: 508. *f. 49, 1–5.* 1920.

Indo-China: Cochinchina, Bien-hoa Province, Chiao-xhan Mountain, *Pierre 6041* (P, fragm. A).

Known only from the type collection; the fruit is unknown.

32. **Ormosia hoaensis** Pierre ex Gagnep. Not. Syst. 3: 32. 1914, et in Lecomte, Fl. Gén. Indo-Chine 2: 510. 1920.

Indo-China: Cochinchina, Bien-hoa Province, Cai River, *Pierre 6041 bis* (A, U).

This species is known only from the type collection. The specimens we have seen are of the Pierre collection, but unnumbered, both sheets from the Cai River, Bien-hoa Province, and both named by Gagnepain. He described the leaflets as 6–12 cm. long and 2.5–4 cm. wide; the largest leaflets on the sheets we have examined are 10–14 cm. long and 3.5–6 cm. wide. The fruits are unknown.

33. **Ormosia tonkinensis** Gagnep. Not. Syst. 3: 200. 1914, et in Lecomte, Fl. Gén. Indo-Chine 2: 510. *f. 49, 7–12.* 1920.

INDO-CHINA: Tonkin, Mount Bavi, near Sougi village, *Balansa 2253* (fragm. A).

Known only from the type collection, the fruits unknown.

34. **Ormosia Tsangii** Chen, sp. nov.

Frutex vel arbor parva, ramis teretibus, glabris, ramulis gracilibus, breviter adpresse pubescentibus; foliis pinnatis, 12–15 cm. longis, rhachi obscure pubescente glabrescente ultra jugum ultimum foliolorum ad 1 cm. vel haud producta; foliolis 5–7, subcoriaceis, supra pallide viridibus vel brunneo-olivaceis, opacis, glabris, subtus consperse adpresse brevissime pubescentibus glabrescentibus, oblongo-ellipticis, 6–8 cm. longis, 2–3.5 cm. latis, breviter acuminatis, basi acutis, costa supra subimpressa, subtus valde elevata; nervis primariis utrinque circiter 8, supra obscuris, subtus gracilibus, haud perspicuis, leviter elevatis, obscure arcuato-anastomosantibus, reticulis primariis sublaxis; petiolulis gracilibus, rugosis, obscure pubescentibus vel glabris, 6–8 mm. longis; inflorescentiis terminalibus et in axillis superioribus, sub fructu valde immaturo paniculatis, ad 9 cm. longis, ramis primariis paucis, breviter adpresse pubescentibus, pedicellis 6–8 mm. longis; floribus ignotis; calycibus persistentibus subcoriaceis, lobis ovatis, 4 mm. longis, 3 mm. latis, utrinque pubescentibus, acutis vel obtusis; ovario dense pubescente, stipitato; leguminibus valde immaturis (seminibus vix efformatis) inflatis, oblongo-ovoideis, extus breviter dense subadpresse pubescentibus, valvis crustaceo-coriaceis, haud 1 mm. crassis, 1.5–2 cm. longis, ad 1 cm. latis; seminibus valde immaturis 1–3, ut videtur levibus, nitidis, duris (maturis rubris ?).

INDO-CHINA: Tonkin, Sai Wong Mo Shan (Sai Vong Mo Leng), near the juncture of the Tonkin-Kwangsi-Kwangtung borders, *W. T. Tsang 30276* (TYPE A), July 18–Sept. 9, 1940.

The fruits are not sufficiently developed to make a complete description feasible, although it is clear that the species represented is different from all hitherto described ones of the genus. We are, however, unable to indicate its proper place in any proposed scheme of classification. It is one of the several species that tends to invalidate *Chaenolobium,* in that on the same branch one notes leaves with the rachis produced and not produced above the insertion of the upper pair of leaflets.

DOUBTFUL AND EXCLUDED SPECIES

ORMOSIA ESQUIROLII Lév. Fl. Kouy-Tchéou 240. 1915, type from Kweichow Province, China = *Sophora japonica* Linn.; see Rehder, Jour. Arnold Arb. 13: 322. 1932.

ANAGYRIS FOETIDA Lour. Fl. Cochinch. 260. 1790.

Macrotropis foetida DC. Prodr. 2: 99. 1790.

Anagyris chinensis Spreng. Syst. 2: 346. 1825.

Anagyris sinensis Steud. Nomencl. ed. 2, 1: 83. 1840.

This is *Sophora japonica* Linn.; see Merrill, Trans. Am. Philos. Soc. II. 24(2): 194. 1935. Loureiro's type, which is not extant, was from southern China.

ANAGYRIS INODORA Lour. Fl. Cochinch. 260. 1790.

Macrotropis inodora DC. Prodr. 2: 99. 1825.

Loureiro's type was from Cochinchina and no authentic specimen is extant. Merrill, op. cit. 194, thought that possibly a species of *Sophora* was represented, but if so Loureiro's description of the fruits must be eliminated. Its Annamese name, as listed by Loureiro, is that of *Sophora japonica* Linn.

List of cited specimens

All specific names pertain to *Ormosia*.

Balansa 2178 Balansae; 2253 tonkinensis.
Chien 5001 Hosiei.
Ching 1709, 2214, 2482, 3188, 5279 Henryi; 7283 apiculata; 7393, 7866, 8480 Fordiana; 7931 sericeolucida; 8300 nanningensis; 8301 kwangsiensis.
Chow 1878 Henryi.
Chun, N. K. 40347 Henryi.
Chun, N. K. & Tso 43490 semicastrata; 43544, 43848, 44088 pinnata; 43772, 44286 Balansae; 44382 xylocarpa.
Chun, W. Y. 6006, 6900 emarginata; 6073, 7453 pachycarpa; 6478 semicastrata.
Chun, Y. F. 30384 Henryi.
Chung, H. H. 967, 6817, 7829 Henryi.
Chung, Z. S. 83359 polysperma; 83405 Henryi.
Clemens 4015 pinnata.
Ford s.n. pachycarpa; s.n. semicastrata; s.n. emarginata.
Fung 20371 pinnata.
Gressitt 1046 pinnata; 1610 polysperma.
Hance 705 emarginata.
Handel-Mazzetti 11482 (482 = 2291) Henryi.
Hayashi 306, 21255 formosana.
Henry 7577 Henryi; 11854 longipes; 11967, 12885 yunnanensis; 12843, 12979, 12979A, 12979B striata.
Hongkong Herb. 443 pinnata; 7259 pachycarpa; 7496, 11223 emarginata.
How 72995 pinnata; 70309 semicastrata; 70397, 72403, 72421, 72898, 72949, 73329 Fordiana; 72498, 72753 simplicifolia; 72604, 73973 inflata; 72892, 73646 Howii; 72920 emarginata; 73170, 72935, 73366 Balansae.
How & Chun 70128, 70158, 70207 pinnata; 70150 semicastrata.
Hu 1298 Henryi; 66020 semicastrata.
Keng 320 Henryi.
Ko 52184 Balansae; 66924 pachyptera.
Kung 3297 Hosiei.
Lau 226, 6135 emarginata; 356, 1141, 2652, 2836, 27283, 27641 pinnata; 4343 polysperma; 28015 Balansae; 28020 inflata; 28379 semicastrata.
Lei 91, 790 pinnata.
Levine 1112, 3456 Henryi.
Li 1667 yunnanensis.
Liang 62010, 62561, 63111, 63487, 64198, 64382, 65101 semicastrata; 62302, 62303, 63773, 64188, 69829 Balansae; 33230, 63025, 62042, 63327, 63336, 63338, 63470, 64621, 66329, 66571 pinnata; 63399, 63623 xylocarpa; 69826 Fordiana.
McClure 7718 pinnata; 8132, 9756 Fordiana; 9809, 13270 semicastrata.
Metcalf 7438 Henryi.
Pételot 3055 Balansae.
Pierre 6041 euphorioides; 6041 bis hoaensis; s.n. cambodiana.
Stewart & Cheo 545 polysperma; 835 semicastrata.
Taam 212 semicastrata; 880, 1040 polysperma.
Tai 1 Hosiei.
Tang 443 pinnata.
Thorel 1415 crassivalvis.
To & Fuson 2664 pinnata.
To & Tsang 12506, 12643 polysperma.
To, Tsang & Tsang 12257 cathayensis.
Tsai 61801 Fordiana.
Tsang 15698, 16196 pinnata; 21484, 21884 polysperma; 22060, 23210, 29989, 30063 Fordiana; 22314, 25830 indurata; 22423 microphylla; 23839, 27144, 28515 Merrilliana; 24147 kwangsiensis; 24427 xylocarpa; 35362 purpureiflora; 26932, 27255, 29112, 29144, 29991, 30725 simplicifolia; 27965 Henryi; 28518 cathayensis; 30082, 30185 emarginata; 30261, 30686 Balansae; 30276 Tsangii.
Tsang & Fung 17859, 18027 Fordiana.

Tsang & Wang 14265 Henryi.
Tsiang 35 emarginata; 755 semicastrata; 791, 1539 Fordiana; 3323, 7754, 10229, 10276 Henryi.
Tso 70414 pinnata.
Ts'oong 1921 Merrilliana.
Wang 2900, 33434, 33625, 35899 semicastrata; 32859, 32902, 33738, 33946, 35478, 36458 pinnata; 33316, 33327 Balansae; 34477, 35703 xylocarpa; 35758, 78153, 79494 Fordiana; 71801, 75758 yunnanensis; 77291 olivacea.
Wilson 808, 1944, 2372, 3407 Hosiei; 2373 Henryi; 9994 formosana.

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MATERIALS FOR A FLORA OF THE CONTINENTAL NORTHWEST TERRITORIES OF CANADA *

A. E. Porsild

INTRODUCTION

Some of the earliest and most important botanical collections ever made in Canada came from the country between Hudson Bay and the Mackenzie River. This region was then known as Rupert's Land, part of which is now included in the present Northwest Territories.

By far the most important and extensive of these collections were made by the surgeon-naturalist and explorer Sir John Richardson, who, between the years 1819 and 1827, accompanied, as physician and naturalist, Sir John Franklin's first and second expeditions "to the shores of the Polar Sea," undertaken in the years 1819–22 and 1825–27. Later, 1848–49, Richardson led an expedition of his own in search of the missing Franklin Expedition of 1845. Large numbers of common Canadian plants and animals, until then unknown to science and to the rest of the world, were described from specimens brought back by Richardson and other members of the Franklin expeditions. It is but a fitting recognition of the work done that so many Canadian plants and animals are named in honor of such men as Richardson, Franklin, Drummond, Sabine, Hood, and Parry, to mention but a few of those intrepid pioneers in the scientific exploration of Canada, who, often under the greatest difficulties, personal danger, and hardship, brought back to the outside world specimens of the then unknown Canadian flora and fauna.

A number of Richardson's plants were described and named by himself, others by Robert Brown in the botanical appendices to the reports of the Franklin expeditions. In all, Richardson reported 474 species of flowering plants and ferns, in addition to lower cryptogams, from what is now known as the Northwest Territories.

In 1819 another British expedition, under W. E. Parry, in the Hecla and the Griper, wintered on Melville Island. The botanical collections made by Edward Sabine and other members of the expedition were described by Robert Brown in his famous "Chloris Melvilliana," thereby laying the foundation for our present knowledge of the flora of Canada's arctic islands. Between 1829 and 1840 appeared W. J. Hooker's classic "Flora Boreali-Americana," which until this day remains one of the standard handbooks on the flora of northern North America. As far as the continental parts of the Northwest Territories were concerned, information on the flora was based almost entirely on the results brought back by the Franklin Expeditions.

In 1859 a young United States naturalist, Robert Kennicott, descended the Mackenzie River to the Peel, and crossed into Alaska. Owing to Kennicott's premature death in 1866, a description of his small but important botanical collection was never published.

* Publication of this paper was made possible by special funds provided for the purpose.—E. D. Merrill.

In the years between 1887 and 1900 important contributions were made by members of the Geological Survey and the Topographical Survey of Canada: from the unexplored country between the Mackenzie drainage basin and Hudson Bay by J. B. and J. W. Tyrrell, and from the western shore of Hudson Bay by Robert Bell.

A comprehensive account of the woody plants of the Mackenzie Basin was given by E. A. Preble in an appendix to his "Biological Investigation of the Athabasca-Mackenzie Region."

John Macoun, in his "Catalogue of Canadian Plants," completed in 1890, included the collections of the latter part of the nineteenth century, but for the geographical distribution of arctic plants depended in the main upon Hooker's Flora. Later additions to the flora of the Northwest Territories, including the important collections made on the west shore of Hudson Bay by J. M. Macoun in 1910, were published in appendices to reports of the Geological Survey of Canada.

In 1906 appeared H. G. Simmons' "The Vascular Plants in the Flora of Ellesmereland" and in 1913 his "Survey of the Phytogeography of the Arctic American Archipelago." These were based largely upon his work as a botanist with Sverdrup's expedition in the Fram, 1898–1902, as well as upon the published and unpublished records of previous collections in the archipelago.

In 1909 C. H. Ostenfeld published the important botanical results of Amundsen's Northwest Passage in the Gjöa, 1904–06. Since the appearance of these works, which had all dealt largely with the flora of the Arctic Archipelago, important collections were made during the Canadian Arctic Expedition of 1913–18, chiefly by Frits Johansen and other members of the southern party under R. M. Anderson. This expedition collected plants along the mainland arctic coast from Alaska eastward to Bathurst Inlet and from the south shore of Victoria Island. The botanical results, by J. M. Macoun, Theodore Holm, Frits Johansen and others, were published in Volumes IV and V of the scientific report.

Members of the Fifth Thule Expedition, 1921–24, under the leadership of Knud Rasmussen, collected plants chiefly in the Keewatin District. An account of their work has been pubished by Johs. Grøntved in the Report of the Fifth Thule Expedition, Vol. 2, No. 1, 1936.

In 1940 appeared the first part of Nicholas Polunin's "Botany of the Canadian Eastern Arctic." This important work brings up to date our knowledge of the flora of the Eastern Arctic, but the area covered by it extends only to the western shore of Hudson Bay.

By far the most important contribution to our knowledge of the flora of the continental Northwest Territories since Hooker's Flora is Hugh M. Raup's "Phytogeographic Studies in the Athabaska-Great Slave Lake Region," 1936, and "Botanical Investigations in Wood Buffalo Park," 1935, based largely upon his own very extensive collections made in the course of several expeditions to that region. In 1939 Raup spent a summer in the Mackenzie Mountains and his report on the flora of this very inaccessible and little-explored region is now in preparation.

In 1927–28 the writer, with his brother, R. T. Porsild, while engaged in a grazing reconnaissance, collected plants in the northwestern part of the Mackenzie District, between the Mackenzie Delta and Anderson River, and in the Great Bear Lake basin.[1] The great distance to be covered, coupled with trans-

[1] A. E. Porsild. Reindeer Grazing in Northwest Canada. Department of Interior Publ. 1929, pp. 1–46.

portation difficulties and the very short arctic summers, made it impossible to do as much collecting as might have been desirable. Thus in one twelve-month period, in 1927–28, the writer moved his camp no less than 106 times. The collections of 1927–28 were added to materially during the years 1932–35, when the writer was stationed in the Mackenzie Delta.

In 1931 the writer made a botanical survey of central Keewatin, from the Yathkyed Lake basin down Kazan River to Baker Lake.[2] The vascular plants collected in the Northwest Territories during this and his earlier and later expeditions aggregate 5600 numbers, or over 30,000 herbarium specimens.

In 1941 appeared the first part of Eric Hultén's monumental "Flora of Alaska and Yukon." The second part, though printed in 1942, has not been widely distributed due to the war. When completed, this will bring together all contemporary knowledge of the flora of that region, which, because of the large land areas known to have been unglaciated there, must be considered the most important, floristically and phytogeographically, in the entire American Arctic.

Only a few trained botanical collectors have ever visited the Northwest Territories, and most of the collections of plants that have found their way into botanical museums and private herbaria have been made by travellers who have had no special botanical training and to whom the collection of plants was not the principal objective. For this reason nearly all species of aquatic plants, as well as some of the difficult and critical families and genera, such as Gramineae, Cyperaceae, Salicaceae, *Potentilla, Antennaria, Taraxacum,* and others, are as a rule but poorly represented in their collections. Until the advent of the airplane all travellers in the north, at least during the summer, were compelled to follow the rivers and navigable canoe routes. Our present knowledge of the flora, therefore, on account of the past inaccessibility of vast areas, is still very incomplete. Large tracts of land are still botanically unexplored, and the continental Northwest Territories even today remain among the least known large land areas in the northern hemisphere.

Thus, while all available data on the floras of adjacent Alaska-Yukon, the Arctic Archipelago, the Eastern Arctic, and the Upper Mackenzie Basin have recently been brought together and published in the works of Hultén, Simmons, Polunin, and Raup, for most of the Mackenzie and Keewatin Districts, Hooker's "Flora Boreali-Americana" still remains the principal published source of information.

Since 1936, the writer has been engaged in the compilation and preparation of materials for a flora of the Mackenzie and Keewatin Districts. The principal modern source of material for this work has been in the collections made by himself and R. T. Porsild, supplemented by a number of small collections gathered by others and located in the National Herbarium of Canada. To this have been added a few data found in other herbaria, chiefly the Gray Herbarium of Harvard University, the herbarium of the New York Botanical Garden, and the herbarium of the University of Copenhagen, Denmark.

This work was almost completed when the war stopped its final preparation and publication. In order to make some of the more important data available to other workers now engaged in studies of adjacent floras, it has been thought desirable at this time to publish, in a preliminary paper, descriptions of new species as well as the more important phytogeographical data. It is hoped that the main work, which will contain keys to the genera and complete data on distribution, as well as copious ecological notes, may be published before long.

[2] A. E. Porsild. Geographical Journal **88**[1]: 1–19. 1936.

At present 806 species, subspecies, and major varieties of well-defined geographical range are recognized in the flora of the Northwest Territories, while the number known to occur in the Mackenzie and Keewatin Districts is about 761. This number is made up as follows: Pteridophyta 27; Gymnospermae 6; Monocotyledoneae 213; Archichlamydeae 310; Metachlamydeae 205.

Phytogeographically the delimitations of the Mackenzie and the Keewatin Districts are unnatural ones. The great Mackenzie valley is a strongly marked phytogeographic boundary, and the flora of the mountainous part of the Mackenzie District which lies to the westward of the valley bears a much closer affinity to the flora of the Yukon Territory and Alaska than to that of the comparatively low and dry peneplain east of the Mackenzie valley. Large parts of this plain are covered with spruce woods and muskegs and must be a formidable barrier to the migration of numerous species of plants.

While, for practical reasons, the political boundaries are adopted to delimit most of the area covered by the present paper, a somewhat more satisfactory arrangement is achieved when the arctic sea-coast and coastal plain of the Yukon Territory are included with the Mackenzie District. This has been done in the present treatment. To the flora of the Mackenzie and Keewatin Districts have thus been added a few species that in Canada are restricted to the Yukon coast.

Of the 761 plants constituting the present known flora of the Mackenzie (including the Yukon coast) and Keewatin Districts, 345 are enumerated in the present catalogue. Nearly one hundred of these are plants that have not previously been recorded from, or that have not been known to occur in, the Northwest Territories, while about 30 are unrecorded from the Mackenzie District only. In addition the following 14 are believed to be "new" to the flora of Canada:

Carex rotundata
Carex rufina
Tofieldia nutans
Salix arbutifolia
Salix Chamissonis
Salix glacialis
Salix lingulata
Salix phlebophylla
Melandrium taimyrense
Draba Palanderiana
Astragalus Collieri
Eritrichium aretioides
Senecio Kjellmanii
Taraxacum alaskanum

Finally, in the writer's collections were 21 species and 4 varieties believed to be new and undescribed. Several of these, in the following list marked with an asterisk, have been described elsewhere, while the rest are described here.

**Potamogeton Porsildiorum* Fern.
Calamagrostis chordorrhiza n. sp.
Calamagrostis lapponica var. *nearctica* n. var.
Poa ammophila n. sp.
Kobresia arctica n. sp.
Carex atrofusca var. *decolorata* n. var.
Carex elynaeformis n. sp.
Carex Morrisseyi n. sp.
Carex rariflora var. *androgyna* n. var.
Melandrium Ostenfeldii n. sp.
Thlaspi arcticum n. sp.
Potentilla pulchella var. *gracilicaulis* n. var.
Oxytropis hyperborea n. sp.
Gentiana Raupii n. sp.
Antennaria crymophila n. sp.
Antennaria neoalaskana n. sp.
**Antennaria philonipha* A. E. Porsild
Petasites arcticus n. sp.
**Taraxacum Carthamopsis* M. P. Porsild
**Taraxacum* spp.[3]

[3] Five or six species of *Taraxacum* in the writer's collection have been named by Dr. Haglund, Lund, Sweden, but, as far as the writer is able to ascertain, the descriptions have not yet been published.

New combinations or names are proposed as follows:

Melandrium Drummondii n. comb. *Astragalus Collieri* n. comb.
Antennaria Ekmaniana n. nom.

The remainder of the plants enumerated in the catalogue are critical entities in the flora or of unusual or little understood distribution.

ACKNOWLEDGMENTS

The writer is deeply indebted to a number of people who in various ways have assisted in this work. First of all he wishes to mention the large share of the collections contributed by his brother, Mr. R. T. Porsild of Dawson, Y. T., who in 1927 and 1928 accompanied him in the field.

To his father, Dr. Morten P. Porsild, Director of the Danish Arctic Station, Disko, Greenland, the writer is deeply indebted for his stimulating and untiring interest in the progress and advancement of this work and for innumerable suggestions and notes on critical species, but above all for his painstaking compilation and preparation, in 1926, of a manuscript pocket flora containing brief descriptions and keys, and in many cases also pen drawings, of all species which, previous to 1926, had been recorded from arctic and boreal America. This pocket flora, in two volumes, proved of inestimable value in the field when, due to the great difficulties of transportation, none but the most indispensable handbooks could be carried.

To the curators and staffs of a number of herbaria—the Gray Herbarium of Harvard University, Cambridge, Mass., the herbarium of the Arnold Arboretum of Harvard University, Jamaica Plain, Mass., the United States National Herbarium, Washington, D. C., the New York Botanical Garden, Bronx Park, New York, the Colorado Experiment Station, Colorado State College, Port Collins, Colorado, and the Botanical Museum of the University of Copenhagen, Denmark—the writer is deeply indebted for making their material of arctic American plants available for study.

The writer particularly wishes to express his gratitude to Professor M. L. Fernald and to Mr. C. A. Weatherby of the Gray Herbarium for valuable help in the solution of critical problems in taxonomy and nomenclature, as well as for much stimulating encouragement during several prolonged and most profitable visits to that institution.

Last, but not least, the writer is indebted to his friend Dr. Hugh M. Raup, of the Arnold Arboretum of Harvard University, whose own work on Arctic and boreal floras, like that of Professor Fernald, has been a constant source of inspiration, and who, over a period of years, has contributed numerous valuable suggestions.

The writer received much assistance in the preparation of the Latin descriptions from Mr. A. W. A. Brown. The descriptions were later revised by Dr. Leon Croizat, of the Arnold Arboretum of Harvard University.

THE CATALOGUE

In the catalogue, serial numbers between *1861* and *5358*, cited without collector's name, are those of the writer and his brother; numbers between *5368* and *7473* are those of the writer alone; in all other cases the collector's name has been given. Due to the necessity for conserving space, specimens are cited by serial number and the briefest possible data needed to identify the geographical position.

INDEX TO MAJOR COLLECTIONS CITED

Place and location	*Date*	*Serial Numbers*
ARCTIC COAST OF YUKON TERRITORY		
Shingle Pt., lat. 69° N.	July 12, 1933	*6729–6730*
"	Sept. 13, 1933	*6899–6911*
"	July 24, 1934	*7081–7115*
Between King & Kay Pts.	July 23, 1934	*7116–7208*
RICHARDSON MTS., west of Mackenzie Delta		
Slopes & foothills near Black Mt., between 1000 and 4000′ elev., approx. lat. 68° N.	July 7–10, 1933	*6577–6728*
Lower slopes of Black Mt.	Aug. 15–17, 1933	*6742–6878*
Lower slopes between 1000 and 1800′ elev.	Aug. 24–25, 1934	*7316–7350*
MACKENZIE RIVER DELTA		
Peel R., 20 mi. above Aklavik, Husky R.	June 27, 1935	*7398–7400*
Peel R., Aklavik	June 6–8, 1927	*1861–1872*
"	July 6, 1927	*3181–3184*
"	Sept. 1, 1934	*7302–7315*
Limestone hills, Campbell Lake	June 15, 16, 1927	*1873–1976*
Campbell Lake	June 17–21, 1927	*1978–2028*
East Branch, vicinity of Reindeer Station, wooded part about 68° 40′–50′ N.	June 26, 1932	*6500–6518*
"	July 31, 1932	*6519–6520*
"	Aug. 7, 1932	*6521–6535*
"	Aug. 14, 1932	*6536–6557*
"	Sept. 4, 1932	*6558–6560*
"	July 30, 1933	*6731–6741*
"	Aug. 6, 1933	*6879–6886*
"	July 30, 1933	*6887–6898*
Lakes near Reindeer Station	Oct. 16, 1933	*6912–6922*
Reindeer Station	June 20, 1934	*6940–6984*
Upper East Branch	July 12, 1934	*6985–7007*
East Branch, near limit of trees	July 21, 1934	*7008–7061*
"	Aug. 19, 1934	*7255–7279*
Reindeer Station	Aug. 10, 1934	*7211–7228*
" in a lake	Aug. 4, 1934	*7229–7249*
"	Aug. 18, 1934	*7250–7254*
"	Aug. 18, 1934	*7280–7299*
Lower East Branch	Sept. 10, 1934	*7300–7301*
"	Oct. 2, 1934	*7364–7371*
Reindeer Station	May–July, 1935	*7372–7380*
Lower East Branch	July 3–5, 1935	*7381–7397*
Mouth of West Branch	Sept. 16, 1933	*6923–6924*
Lake between East Branch & Eskimo Lake	Nov. 1, 2, 1933	*6930–6939*
South end of Richards Isl., 69° N.	July 22, 1934	*7062–7080*
"	July 18, 1927	*2029–2130*
North end of Richards Isl., 69° 30′ N., 134° W.	July 22–24, 1927	*2131–2296*
"	July 26, 1935	*7448–7455*
Hendrickson Isl.	July 26, 1935	*7456–7463*
Kendall or Garry Isl.	December, 1927	*3185–3187*
Kittigazuit, 69° 22′ N., 133° 40′ W.	July 19, 20, 1927	*2297–2411*
Fish camp east of Kittigazuit	July 24–28, 1927	*2412–2530*
ARCTIC COAST, between Mackenzie and Anderson Rivers		
Tuktuayaktoq (Pt. Hearne)	July 25, 1935	*7402–7447*
Atkinson Pt., 70° N., 131° 20′ W.	Aug. 1–3, 1927	*2531–2681*
Cape Dalhousie, 70° 20′ N., 129° 55′ W.	Aug. 7–14, 1927	*2682–2812*
Liverpool Bay, 70° N., 129° W.	Aug. 15, 16, 1927	*2813–2951*

Place and location	*Date*	*Serial Numbers*
ESKIMO LAKE BASIN		
Kugaruk, entrance to Lakes	Aug. 31, 1927	*3077–3095*
2nd Lake, west end	Aug. 19, 1927	*2952–3018*
Narrows between 3rd & 4th lakes	Aug. 20, 1927	*3019–3076*
Setidgi Lake	Aug. 21, 22, 1927	*3096–3180*
MACKENZIE RIVER		
Bear Rock, below Norman	July 23, 1928	*3375–3399*
Ramparts above Good Hope	Sept. 19, 1928	*3402–3405*
"	Sept. 25, 1928	*7472–7473*
Mackenzie R. between 62° 20′ and 65° 40′ N.	Sept. 17–27, 1931	*6561–6573*
GREAT BEAR LAKE		
Bear River	June 15, 1928	*3238–3274*
Mt. Charles	July 16, 1928	*3275–3321*
"	Sept. 2, 1928	*3322–3370*
Keith Arm, Ft. Franklin	May 11–June 13, 1928	*3188–3237*
" Russel Bay	Aug. 26–28, 1928	*3407–3467*
Etacho Point, 1500′ elev.	Aug. 24, 1928	*3468–3524*
Smith Arm: north shore	July 16–26, 1928	*5054–5087*
Dease Arm: north shore	June 23–26, 1928	*4661–4730*
Barrens near headwaters of Horton River	June 19–21, 1928	*4731–4751*
Foot of Dease Arm	June 7–Aug. 1, 1928	*4752–4882*
North shore	June 27–July 22, 1928	*4883–5053*
Cape McDonnel	Aug. 1, 1928	*5088–5164*
McTavish Arm: north shore	Aug. 4–6, 1928	*5165–5252*
Head of Edna Travers Bay	Aug. 8, 1928	*5253–5285*
East coast	Aug. 8–11, 1928	*5286–5350*
Southern portion	Aug. 13–21, 1928	*3599–3786*
Leith Point	Aug. 23, 1928	*3525–3598*
Miscellaneous small collection	1928	*6182–6200*
KEEWATIN DISTRICT		
Lake on Tha-anne R., 60° 58′ N., 97° W.	July 12, 13, 1930	*5544–5607*
West Coast of Hudson Bay, Mistake Bay, 62° 05′ N.	July 20–29, 1930	*5608–5730*
Yathkyed Lake on Kazan R., 62° 30′–63° N., 97°–98° 30′ W.	Aug. 1–15, 1930	*5731–5861*
Lower Kazan R.	Aug. 16–26, 1930	*5992–6074*
Baker Lake, 64° 30′ N., 97° W.	Sept. 2, 3, 1930	*6075–6129*
Chesterfield	Sept., 1930	*6130–6175*
MISCELLANEOUS COLLECTIONS		
Chesterfield Inlet, *Dr. Currie* (Polar Year Exp.)		*1–72*
Yellow Knife Reserve, 63°–64° N., 109°–114° W., 1936, *John Carroll*		*1–25*
Barrens between Backs and Thelon R., 64° 20′ N., 104° W., *John Carroll*		*26–67*
Thelon Game Sanctuary, 1936, *C. H. D. Clarke*		*1–116*
Coppermine R., 1931, *A. M. Berry*		*1–28*
Foothills west of Mackenzie Delta, 1931, *O. Bryant*		*unnumbered*

The symbols mentioned below indicate the herbaria in which the specimens cited were seen. Where no symbols are appended, the specimens are in the National Herbarium of Canada.

C—Herbarium of the University of Copenhagen, Denmark

Can—Herbarium of the National Museum of Canada, Ottawa

G—Gray Herbarium, Harvard University, Cambridge, Mass.

NY—Herbarium of the New York Botanical Garden, New York, N. Y.

US—United States National Herbarium, Washington, D. C.

The families and genera are arranged essentially according to Dalla Torre and Harms, Genera Siphonogamarum (1900–1907). Within the genera the

species, for the sake of convenience, are arranged alphabetically, except in the genus *Carex*, where the arrangement followed is that of Mackenzie in N. Am. Flora **18** (1935).

EQUISETACEAE

Equisetum palustre L.

Mackenzie River Delta: Aklavik, *3181;* Great Bear Lake: North shore of Smith Arm, *4981;* McTavish Arm, Conjuror Bay, *4858.*

Recorded by Richardson "to the shores of the Arctic Sea," but not otherwise known from the Northwest Territories.

SELAGINELLACEAE

Selaginella selaginoides (L.) Link.

Great Bear Lake: Keith Arm, Russel Bay, *3416, 3433;* south shore, Leith Pt., *3563;* Dease Arm, north shore, *4662.*

New to the flora of the Northwest Territories.

Selaginella sibirica (Milde) Hieron.

Richardson Mts.: East slope, west of Mackenzie Delta, about 68° N., 2000–4000′ elev., *6633, 6746;* Mackenzie River Delta: East Branch, 68° 40′ N. to 68° 55′ N., *6559, 6574, 7008;* south end of Richards Isl., *2031.*

New to the flora of the Northwest Territories and not previously recorded from north of Lake Athabaska.

ISOËTACEAE

Isoëtes Braunii Dur.

Great Bear Lake: McTavish Arm, (plants with mature macrospores) *3688.*

In the Mackenzie Basin *I. Braunii* was previously collected on Lake Athabaska (*Raup & Abbe 4617*). It is thus new to the flora of the Northwest Territories.

POTAMOGETONACEAE

Potamogeton pectinatus L.

Mackenzie River Delta: Lake near the East Branch, 68° 40′ N., *6913, 6915, 7244.*

The last number, collected on Aug. 11, 1934, has immature fruit, showing that in the Mackenzie Delta the species produces fruit at least in favorable seasons. *Potamogeton pectinatus* in Canada was known previously north to Lake Athabaska.

SPARGANIACEAE

Sparganium angustifolium Michx.

Eskimo Lake Basin: Setidgi Lake, *3097, 3173* (the last with mature fruiting heads); Great Bear Lake: McTavish Arm, *5334.*

Sparganium simplex, in Hook. Fl. Bor.-Am. 2: 169. 1839, "to Ft. Franklin," may belong here, but otherwise the species has not been previously recorded from north of Great Slave Lake.

Sparganium hyperboreum Laest.

Mackenzie River Delta: West Branch (Husky River), *7316;* Eskimo Lake Basin: *2954, 3059, 3125;* Great Bear Lake: *3434, 4983, 5056;* Keewatin Distr.: Yathkyed L., *5732, 5998;* Tha-anne R., *5550;* Churchill, Mosquito Pt., *5521.*

Apparently common and in favorable seasons maturing fruit north to, or slightly beyond, the limit of trees.

Sparganium eurycarpum Engelm.

Mature fruiting heads were collected by the writer on the Mackenzie River, near Ft. Norman, in September, 1928. In the Mackenzie basin not previously recorded from north of Lake Athabaska.

SCHEUCHZERIACEAE

Triglochin maritima L.

Mackenzie River Delta: Campbell L., *1899;* Kittigazuit, *2301;* Great Bear Lake: *3261, 3671, 4664, 5089, 5165.*

Triglochin palustris L.

Mackenzie River Delta: Recorded in many places (A. E. Porsild, field notes); Great Bear Lake: *4664A, 4785, 5166;* Keewatin Distr.: Mistake Bay, *5612.*

The above numbers represent the first collections from the Mackenzie basin north of Great Slave Lake, and the first from Keewatin District.

GRAMINEAE

Beckmannia Syzigachne (Steud.) Fern.; Raup in Jour. Arn. Arb. **17**: 209. 1936.

Beckmannia erucaeformis R. & S.; Richardson in Franklin's Journ. App. 731. 1823.

Although Richardson apparently collected this plant, Hooker, Fl. Bor.-Am., has not included it. Richardson does not give any stations but merely lists it under "W" ("wooded country from latitude 54° to 64° north"), and Raup's, l. c., seems to be the first specific record from the Northwest Territories (*Miss E. Taylor 30099* [Can], Ft. Simpson). Along the lower Mackenzie River, *B. Syzigachne* occurs sporadically near settlements as a weed introduced from the upper river with native hay shipped north with livestock. In the Mackenzie Delta, in addition, there occurs a plant which apparently is indigenous, but of a very curious local distribution. It inhabits muddy shores of certain shallow, stagnant lakes flooded during the early part of the season. But even in such places its occurrence is sporadic (Mackenzie River Delta: East Branch, *6898* and *7235*). The seeds are eagerly eaten by wild ducks, and the fact that the plant grows in places frequented by these birds suggests that the latter distribute the seeds. Were the seeds carried by flood water the distribution would, no doubt, be more general.

Schizachne purpurascens (Torr.) Swallen.

Great Bear Lake: McTavish Arm, Conjuror Bay, *3643.*

New to the flora of the Northwest Territories.

Muhlenbergia Richardsonis (Trin.) Rydb.

Great Bear Lake: Bear River, *3357.*

New to the flora of the Northwest Territories.

Calamagrostis chordorrhiza sp. nov.

Gramen perenne laxe caespitosum, rhizomatibus longis sublignosis subnitidis perramificatis; culmi ascendentes aut geniculati, 30–35 cm. alti, omnino scabri, solitarii aut aggregati, phyllopodici, binodosi; folia inferiora caulina numerosa, aggregata, brevia, laminis planis latisque instructa, superioribus angustioribus valde reductis; folia axium sterilium numerosa, in fasciculis foliosis conferta, culmo maturo dimidio breviora; lamina 3 mm. lata, plana, marginibus parce involutis abrupteque acuminatis, glauca, utrinque scaberrima; ligula triangularis, 2 mm. longa, erosa; panicula laxa angusta, 5–6 cm. longa et 1–1.5 cm. lata, ± interrupta; rami breves hispidissimi, inferioribus remotiusculis; glumae aequales, 2.5–3 mm. longae, acuminatae vel fere cuspidatae, parum purpuras-

centes; carina subhispida, marginibus vix puberulens, marginibus angustis pellucidis instructa; flosculus 2–2.3 mm. longus, lemmae firmiusculae infra virides, apicibus stramineis, arista recta vel rarissime subgeniculata, quam lemma quinto minor, evidenter infra medium orta, palea pellucida, lemmam aequans; pili ad basim paleae inaequales, copiosi, longissimi aequi ac lemma tantum longi; rhachillae nodo brevissimo.

Mackenzie River Delta: East Branch, 68° 40′ N., hills back of Government Reindeer Station, forming large cushions in sandy soil, Aug. 7, 1932, *A. E. Porsild 6524* (type). Thus far known only from the type locality.

Calamagrostis chordorrhiza, because of its small spikelets and small, straight awn, may be related to *C. neglecta* (Ehrh.) Gaertn., while its very scabrous and glaucous leaves and strong rhizomes are somewhat suggestive of *C. purpurascens.* Our plants are late-flowering but the floral parts appear quite normal and do not suggest hybrid parentage. By its fascicles of flat, crowded and glaucous leaves and strong, cord-like rhizomes, *C. chordorrhiza* seems so well-marked from all other species of *Calamagrostis* known to the writer that he can see no other alternative than to consider it undescribed.

Calamagrostis deschampsioides Trin.

Although Polunin (in Nat. Mus. Can. Bull. **92**: 50. 1940) was the first to record this species from Canada, the writer and his brother, in 1927, collected it in the Mackenzie Delta (north end of Richards Island, July 22–24, 1927, *2136, 2137;* Arctic Coast: Atkinson Point, *2558*). In the writer's collection also are specimens from Churchill, Man., *5378.*

Calamagrostis lapponica (Wahlenb.) Hartm. var. **nearctica** var. nov.

Calamagrostis lapponica (Wahlenb.) Hartm.; Britton & Rydberg in Bull. N. Y. Bot. Gard. **2**: 154. 1901.

Calamagrostis canadensis var. *Langsdorffii* sensu Porsild in Rhodora **41**: 179. 1939, pro min. parte, non Link.

A specie differt statura semper minore (35–50 cm. neque 50–120 cm.), panicula breviore angustiore (4–8 cm. neque 5–15 cm.), glumis parum brevioribus angustioribusque (4 mm. neque 5 mm.).

The writer, in 1927 and 1928, collected in various parts of the Mackenzie District what he then took to be a slender form of *C. canadensis* var. *Langsdorffii.* From 1932 to 1935, when he was a resident of the Mackenzie Delta, this plant was grown from seed in its natural habitat and also studied in the field. It was realized then that the plant did not belong with the polymorphous *C. canadensis,* and he at first thought it to be an undescribed species widely distributed in arctic and subarctic parts of Northwest America, since clearly it could not be referred to any American species. Comparison with European and Asiatic species has shown, however, that it must be referred to *C. lapponica* (Wahlenb.) Hartm., although it differs so consistently from that species in size that it seems best treated as an American (? and E. Asiatic) race or variety. The following is a more detailed description.

Loosely caespitose with short, thin rhizomes; culms solitary or few together, slender, erect, 30–60 cm. high, glabrous except just below the panicle, with 2 or 3 nodes, the cauline leaves strongly involute; leaves about half as long as the mature culms, about 2 mm. wide, flat, or more often strongly involute, essentially glabrous; ligule short and entire, almost truncate, 1.5–2 mm. long, sometimes tinged with purple; panicle lax, suffused with purple, narrow to somewhat open, 4–6–8 cm. long and 1.5, rarely 2, cm. wide, the branches very hispid, the

longest 2.5 cm. long; glumes 4–4.5 mm. long, slightly lustrous and strongly suffused with purple, with stramineous margins and tips, abruptly acuminate, hispidulous-scabrous on the keel and sparsely scabrous on the sides; floret 3.6–3.7 mm. long, the lemma truncate, 7-nerved (counting mid-nerve, which is wanting above the base of the awn), scabrous except at the hyaline summit; awn arising ⅓ from the base, erect, straight or rarely slightly bent in the lower half, barely equaling the lemma; palea 2.7 mm. long, erose-truncate, the margins and upper half hyaline, the nerves scarcely reaching to the apex; callus hairs unequal, the longest nearly as long as the lemma; rhachilla joint 1 mm. long, its hairs copious, as long as the lemma, a few slightly longer.

In old sand dunes or in peaty soil or in open heath and muskegs, on the arctic coast from Norton Sd., Alaska, east to Hudson Bay, south to Great Bear Lake and mountains of central Yukon and Alberta.

Mackenze River Delta: East Branch, 68° 40′ N., two-year-old plants grown from seed (collected with specimens of no. *6525*), Aug. 12, 1934, *A. E. Porsild 7282* (type). *Calamagrostis lapponica* var. *nearctica*, in addition, is represented by the following specimens in the National Herbarium of Canada: Alaska: Norton Sd., Pastolik, *955* (distributed as *C. canadensis* var. *Langsdorffii*); Yukon Territory: Lake Kluane to Don Jek River, Aug. 11–27, 1920, *Adolf Müller* (distr. as *C. scabra* Presl); Klondike, Indian Divide, *John Macoun 54626* (distr. as *C. neglecta* Ehrh.); same place, *John Macoun 54627* (distr. as *C. canadensis* Michx. var. *acuminata* Vasey); Mackenzie District: Mackenzie River Delta, East Branch, 68° 40′ N., solitary culms in dry heath, Aug. 7, 1932, *6525* (topotype); Eskimo Lake Basin, north shore of 2nd lake, low, marshy tundra, *2959, 2960;* Great Bear Lake, Keith Arm, Russel Bay, open willow thickets, *3408;* same place, sand dunes along lake shore, *3419;* Keewatin District: Yathkyed L. on Kazan River, dry hillsides, *5738;* Baker Lake, *A. Dutilly 4513* (distr. as *C. purpurascens*); Chesterfield, west coast of Hudson Bay, dry tundra, *6132.* The following, from high mountains of Alberta, differ chiefly in slightly smaller (3 mm.) and more glabrous glumes: Alberta: Mountain Park, Mt. Harris, 7000 ft. elev., Aug. 13, 1925, *Malte & Watson 2134, 2153;* back of "Miner's Roof," 6000 ft. elev., Aug. 11, 1925, *Malte & Watson 2017.*

Calamagrostis lapponica var. *nearctica* may be distinguished from all other N. American species of *Calamagrostis* by its narrow, lax panicle, which is strongly suffused with purple, its short and often involute leaves, and by its solitary culms, its long callus hairs, and straight awn. On the other hand it is a good match for *C. lapponica,* Fl. Dan. Suppl. 1, *tab. 5* (1853), as well as for specimens in the National Herbarium of Canada thus labeled, exemplified by: "Pl. Finl. Exsicc. No. 456, Lapponia Kemensis, Aug. 2, 1913, leg. U. Segerman" and "Montes uralenses septentrionales (lat. bor. inter 64° et 65°), July 27, 1927, leg. V. Soczava, no. 386," but it is consistently smaller than the plant called for in the original description as well as the plant described by modern European authors such as Holmberg (Skandinaviens Flora **1**[1]: 153. 1932) and Roshevitz (in Komarov, Fl. U. R. S. S. **2**: 219. 1934). The former gives the following extra-Scandinavian distribution: "N. Russia; Siberia; N. America; Greenland." Holmberg's American record may be based upon a note by Fernald in Rhodora (**13**: 123. 1911), and the Greenland one undoubtedly refers to *C. lapponica* Hartm. var. *groenlandica* Lange (Conspectus Fl. Groenlandica **2**: 296. 1887), which is *C. hyperborea* Lange.

Calamagrostis lapponica has from time to time been recorded from North America (Britton & Rydberg, l. c.; Rhodora, l. c.; St. John in Vict. Memorial Mus. Mem. **126**: 64. 1922; Stebbins in Rhodora **32**: 56, *tab. 195, fig. 9.* 1930; Victorin, Fl. Laurentienne 792. 1935), but all but the record of Britton and Rydberg seem very doubtful, and all plants thus labeled, seen in America her-

baria by the writer, seem best referred to *C. neglecta* (Ehrh.) Gaertn. or to *C. hyperborea* Lange. Certainly *C. lapponica* var. *brevipilis* Stebbins (Rhodora, l. c.) should be referred to *C. neglecta* (Ehrh.) Gaertn.

In his revision, Stebbins, l. c., appears to have overlooked the plant noted as *C. lapponica* (Wahlenb.) Hartm. by Britton and Rydberg, l. c., from the Yukon. Their description and discussion clearly show that their plant is *C. lapponica* var. *nearctica,* and it thus appears that theirs is the first authentic record of *C. lapponica* from North America.

Trisetum sibiricum Rupr.

Trisetum flavescens Ostenf. in Gjöa Exp. 32. 1910.

Ostenfeld, l. c., "with some doubt," recorded this species from King Point on the Arctic coast of Yukon Territory, stating that the specimens were very poor and much too young. The writer succeeded in finding mature specimens, probably in the identical place: Between King and Kay Points, 69° 12′ N., 138° 30′ W., July 23–25, 1934, *7122.*

Poa ammophila sp. nov.

Gramen perenne dense caespitosum, rhizomate brevi colonias densas compactas formante; culmi 20 cm. raro 35 cm. alti, erecti vel parum ascendentes, rigidi, perglabri, folia circa duplo superantes, foliis 1 aut 2 in parte inferiore muniti; folia glabra, cinereo-viridia rigida, involuto-conduplicata; vaginae subinflatae, persistentes, nitidiusculae, ligula acuminata, circa 1.5–2 mm. longa; panicula etiam tempore anthesi angusta, circa 4 cm. longa et 0.5–0.8 cm. lata, ramis brevibus appressisque, glabris vel scabriusculis; spiculae circa 6 mm. longae, plerumque triflorae, haud conspicue compressae; glumae aequales, circa 4 mm. longae, strictae, carinatae, parte superiore tertia glabrae aut subscabrae, subnitidae, purpurascentes, margine late scariosae, acuminatae; lemmae circa 3.5 mm. longae, forma glumas simulantes, dorsaliter brevi-pubescentes, basi haud ciliata obscure uninervatae, membranaceae; antheris circa 1.4 mm. longis.

Arctic Coast: Cape Dalhousie, 70° 20′ N., 125° 55′ W., forming colonies on sandy hills back of coast, Aug. 7–14, 1927, *2704* (type); 6 miles east of Kittigazuit, *2422;* Cape Dalhousie, a luxuriant form 35 cm. tall, *2706;* Liverpool Bay, *2827;* Mackenzie River Delta: North end of Richards Isl., *2154;* Kittigazuit Island, *2311.* In no. *2827* the spikelets are less flattened, the glumes are shorter and less prominently keeled, and the ligule is somewhat shorter than in the type. *Poa ammophila* is a characteristic plant of old sand dunes and sandy hilltops along the arctic coast from the Mackenzie Delta east to the mouth of Anderson River.

Poa ammophila superficially resembles *P. Hartzii* of Greenland, recently, with some doubt, reported also from Ellesmere Island (Polunin in Nat. Mus. Can. Bull. **92**: 69. 1940), but the abundant material on hand all differs from it in the much shorter ligules and the much shorter and less abundant pubescence of the lemmas. In fact it seems very close to some Cordilleran species, and, following Rydberg, Fl. Rocky Mountains, it seems best placed in the section *Rupicolae,* where it most closely matches *P. Pattersoni* Vasey. This, however, is said to have a short, truncate ligule. Except that the glumes are longer than the lemmas, it matches the original description of that species and also a specimen from the type locality: Gray's Peak, Colorado, 13,000 ft., Aug. 15, 1885, *G. W. Letterman* (Can). It is also a close match for *Poa Suksdorfii* Vasey, Mt. Rainier, Wash., Aug. 14, 1895, *O. D. Allen 183* (Can). Our plant, however, is a good deal taller and also differs so much from half a dozen other sheets in the National Herbarium of Canada named *P. Pattersoni* by Rydberg and others that the writer hesitates to refer it to that species.

Festuca altaica Trin.

Richardson Mts.: West of Mackenzie Delta, 68° N., 3000–4000′ elev., *6636;* Great Bear Lake: Dease Arm, *4667;* north shore of Smith Arm, *5070;* Arctic Coast of Yukon Territory: Near Shingle Pt., *6902, 7083.*

New to the flora of the Northwest Territories.

Agropyron latiglume (Scribn. & Merr.) Rydb.

Agropyron alaskanum Scribn. & Merr., Macoun & Holm in Rept. Can. Arct. Exp. **5A**: 8. 1921.

Occasional in sandy or somewhat peaty soil from the mountains west of the Mackenzie Delta, east along the Arctic Coast and on islands of the Arctic Archipelago; Kazan River, south of Baker Lake (no. *6000*), and south to Great Bear Lake and the east end of Great Slave Lake. Also in Yukon Territory and Alaska.

Agropyron trachycaulum (Link) Malte.

Mackenzie River Delta: East Branch, 68° 40′ N., *6519;* south end of Richards Isl., *2048;* 6 miles east of Kittigazuit, *2416;* Great Bear Lake: Dease River valley, *4864;* north shore of Smith Arm, *5067;* north shore of McTavish Arm, *5195.*

Agropyron trachycaulum in its distribution is more southern than *A. latiglume* and in the Northwest Territories does not reach far beyond the limit of trees. It seems always restricted to alluvial soils. On clay banks of the East Branch of the Mackenzie Delta it forms large, firm tussocks, one meter or more in diameter and often 1.25 m. high, and has spikes 16 cm. long.

Our material is all rather uniform. The lemmas are pubescent with a short awn and the sheaths are glabrous. According to Malte's revision (Ann. Rep. Nat. Mus. Can. **1930**: 48. 1932) this would place it with var. *pilosiglume* Malte, known only from the type locality, Vancouver Island, B. C., which somehow does not make sense.

Elymus innovatus Beal.

Elymus mollis R. Br., sensu Hook. Fl. Bor.-Am. **2**: 255. 1840, not Trin., at least in part.

Richardson Mts.: Foothills west of Mackenzie Delta, *6634;* Mackenzie River Delta: E. Branch, 68° 40′ N., *6501, 6521;* Mackenzie River: Bear Rock, 1300′ elev., *3375;* Great Bear Lake: Bear River, Mt. Charles, *3324.*

A western species restricted to calcareous soils of the interior; in the Mackenzie country it barely reaches north to the limit of trees.

CYPERACEAE

Eriophorum callitrix Cham.

Since Fernald (in Rhodora **27**: 203–210. 1925) cleared up the true identity of *E. callitrix* and its distribution in North America, our knowledge of the known range of this plant has been enormously increased. Polunin's prophetic statement (l. c., 102) that "when explorers have learned to overlook it less it may prove circumpolar" may indeed some day come true. It has already turned up in East Greenland, and its discoverer, G. Seidenfaden, with Th. Sørensen, has since published a paper on the geographical distribution of it and allied species (Medd. om Grønland **101**[1]: 1–27. *tab. 1, 3,* 1933). To the latest new stations in Alaska recently given by Porsild (in Rhodora **41**: 199. 1939) and in the Eastern Arctic by Polunin, l. c., should be added the following:

Richardson Mts.: West of Mackenzie Delta, 2000–3000′ elev., *6639;* Great Bear Lake: Foot of Dease Arm, *4753;* north shore, Haldane R., *5026;* Keewatin Distr.: Tha-anne R., 60° 58′ N., 97° W., *5570;* James Bay: S. Twin Isl., *4205.* Also, in the Gray Herbarium, is a specimen from Montana: Custer National Forest (*L. O. Williams 3706*). *E. callitrix* appears to be restricted to calcareous soils.

Eriophorum medium Anders.

Mackenzie River Delta: East Branch, *6958;* S. end of Richards Isl., *2050;* Keewatin Distr.: Tha-anne R., *5570B;* Yathkyed Lake, *5755, 5756;* Kazan R., *6018.*

Eriophorum opacum (Bjørnstr.) Fern.

Mackenzie River Delta: Peel R., above Aklavik, *7400;* Campbell Lake, *1885.*

Eriophorum opacum in the north is the latest-flowering species in this genus and is confined to muskeg forest. Its range is decidedly more southern than that of the other caespitose species. Where Seidenfaden and Sørensen, l. c., give the world range of *E. opacum,* the reader is astonished to find that among other stations under the heading "Arctic America" are "Hastings County, Ontario and Prince Albert, Sask.," and that Churchill, Manitoba, has been placed in the Northwest Territories. In fact the reader might easily be misled to believe, with Seidenfaden and Sørensen, that the American range of *E. opacum* is arctic.

Eriophorum vaginatum L.

The true *E. vaginatum* of Eurasia is a very common species in the northern parts of the Mackenzie District, where it is a dominant species in "climax" tundra. The species in the Mackenzie Delta flowers late in May. Late snow or rain during anthesis may completely ruin the season's seed crop; but otherwise, during late July, large tracts of land, or sometimes the entire landscape, turn completely white as if covered with snow. Heads composed entirely of pistillate flowers are as common as the normal bisexual ones. The anthers are from 2.1 to 2.6 mm. long, the achenes flat-trigonous, almost black, 2–3 mm. long, and 2 mm. wide.

East of the Mackenzie Delta *E. vaginatum* becomes progressively less ubiquitous, and at Great Bear Lake it no longer dominates. It is still less common in Keewatin District and east of Hudson Bay, and in the southern parts of the Mackenzie District it is replaced by the very closely related *E. spissum* Fern.

Eleocharis acicularis (L.) R. & S.

Mackenzie River Delta: Forming masses of vegetation in nearly all lakes (var. *submersa* (Hj. Nilss.) Svenson), while the fertile plant grows abundantly on wet, muddy shores; East Branch, *6918, 7236, 7410,* the last number fertile and grown in the writer's garden on the East Branch from seed; Arctic Coast: East of Kittigazuit, *2452* (var. *submersa*); same place, *2432* (fertile); Great Bear Lake: Dease Arm, *4669, 4789;* Smith Arm, *4987;* McTavish Arm, *3691;* Keewatin Distr.: Yathkyed Lake on Kazan R., *5749* (fertile), *5750* (var. *submersa*); Lower Kazan R., *6019;* Baker Lake, *6180* (sterile); Mistake Bay, west shore of Hudson Bay, *5623* (sterile).

Not previously recorded from north of Great Slave Lake.

Eleocharis palustris (L.) R. & S.

Great Bear Lake: North shore of Dease Arm, *4668;* Great Bear River, *3376.*

Previously recorded from Bear Lake by Richardson.

Eleocharis pauciflora Link.

Great Bear Lake: North shore, Haldane R., *4914;* Dease Arm, *4670;* Smith Arm, *4987A;* McTavish Arm, *5170;* south shore, Leith Pt., *3529.*

Not previously recorded from north of Great Slave Lake.

Scirpus validus Vahl.

Mackenzie River: Near Ft. Norman, *5367.*

Only record north of Great Slave Lake.

Kobresia caricina Willd.

Kobresia bipartita (All.) Dalla Torre.

Common or occasional in rather dry tundra and represented by many numbers in the writer's collection, from the Mackenzie Delta east to Hudson Bay. Not previously collected north of Great Slave Lake.

Kobresia arctica sp. nov.

Planta densissime caespitosa, colonias parvas sed compactissimas formans raro 15 cm. diametro superantes; rhizomata brevissima, ascendentia, crassa, non-stolonifera; culmi 12–35 cm. alti, flavo-virides, rigidi, obtusanguli, leves, maturi folia multum superantes, phyllopodici vaginis annorum praecendentium siccis persistentibus valde obviis; folia erecta, longe attenuata, opaca viridia, angusta, valde canaliculata, facie teretia, marginibus parte tertia inferiore scabriusculis; vaginae opacae castaneae; spica solitaria, ovata vel ellipsoidea, ebracteata, 1–1.8 cm. longa ac 0.5–0.8 cm. lata; spiculae circa 20, unaquaque florem masculum simul cum foemineo continente duobus infimis exceptis in rhachillis vestigialibus impositis, flores 2 vel 3 foemineos, masculum 1 continentibus; squamae persistentes, late ovatae, obtusae, opacae, obscure castaneae centro pallidiores, marginibus angustis pellucidae; nuculae 3–4 mm. longae, utriculis chartaceis persistentibus breviores, obovoideae, obvie triangulares, pallidae brunneo-cinereae, glabrae, opacae, enervosae, brevistipitatae fere erostres; stylus tenuis nuculam subaequans; stigmatibus 3.

In rather dry, peaty tundra from mountains west of the Mackenzie River east to Back's River and south to Great Bear Lake. Also islands of Bering Sea and in eastern Siberia (?). Mackenzie River Delta: Kittigazuit Island, 69° 22′ N., 133° 40′ W., common in dry tundra, July 19, 20, 1927, *A. E. & R. T. Porsild 2318* (type); Richardson Mts.: West of Mackenzie River Delta, in peaty soil, alpine tundra, 3000′ elev., approx. 68° N., 136° W., *6757;* Arctic Coast of Yukon Territory: *7125;* Mackenzie River Delta: Mainland near reindeer corrals, *7381;* Hendrickson Isl., *7456;* Kittigazuit Isl., *7371;* north end of Richards Isl., *2159;* Arctic Coast: Atkinson Pt., *2562;* Cape Dalhousie, *2712;* Liverpool Bay, Nicholson Isl., *2834;* Great Bear Lake: North shore of Dease Arm, low tundra, *4884;* Keith Arm, Russel Bay, *3421;* Cape McDonnel, *5101;* Mackenzie Distr.: South of Back's River, 64° 30′ N., 104° 20′ W., July 28, 1936, *J. Carroll 27.* The above are all in the National Herbarium of Canada. In addition the writer has seen a specimen in the Gray Herbarium, collected by the United States North Pacific Exploring Expedition in 1853–56, labelled "*Elyna caricina* Mert. & Koch, Arakamtchetchene Island, Behring Straits, C. Wright coll." This appears to match our material, although an uninitialed note on the sheet, presumably by Mackenzie, says: "*Kobresia caricina.*"

Kobresia arctica is perhaps most closely related to *K. macrocarpa* Clokey, of alpine peaks in Colorado, which, however, is well-marked from ours in having "the terminal flowers staminate and the lateral pistillate" and by having leaves that equal or exceed the culm. *Kobresia schoenoides* of alpine Eastern Asia is a much more robust plant with culms 35 to 50 cm. tall and with very conspicuous and shiny old sheaths. One sheet at Copenhagen thus named, and labelled "Pl. lenensis subarcticae, Sib. Jakutsk, Bulkur 72°, Sept. 1898, Herm. Nilsson," is much taller than our plant but otherwise seems closer to *K. arctica* than to *K. schoenoides.*

Carex nardina Fries var. **Hepburnii** (Boott) Kükenth. in Pflanzenr. 38(IV. **20**): 70. 1909.

Carex Hepburnii Boott in Hook. Fl. Bor.-Am. **2**: 209, *tab. 207.* 1839; Mackenzie in N. Am. Flora **18**: 22. 1931, *tab. 2.* 1940.

Boott's name was based upon a plant from the Canadian Rocky Mts. and was published a few months after Fries had described his *C. nardina,* based upon material from Greenland. Boott, however, had seen specimens of the Greenland plant sent to him by Hornemann, for under the distribution of *C. Hepburnii* he added "Greenland, Horn. in herb. Hooker." In the National Herbarium of Canada there is a duplicate from Boott's herbarium labelled "C. nardina Fries—C. Hepburnii Boott—Greenland." Boott, nevertheless, could not have

known the Greenland plant very well, for he does not compare the two and his description of *C. Hepburnii* is in such general terms that it applies almost equally well to *C. nardina*. The details of his plate, however, leave no doubt as to the identity of his *C. Hepburnii,* whereas the drawing of the plant itself is not characteristic of that species. It is easy to understand, therefore, that the critical student of *Carex,* S. Drejer (Revis. Crit. Caric. 437. 1841) reduced *C. Hepburnii* to synonymy, although it is worth noting that in the discussion he remarks "Figura cl. Boottii bene habitum nostrae planta C. nardina exprimit, sed descriptio perigynii et analyses depictae non satis correctae." Steudel (Syn. Pl. Cyp. 184. 1855) followed Drejer, while much later Kükenthal (Pflanzenreich 38 (IV. 20) : 70. 1909) took up Boott's name as a variety of *C. nardina* but reserved it for the plant of the mountains of Pacific N. W. America. At the same time he gave a brief but good description of the plant. Rydberg (Fl. Rocky Mts. 119. 1917), giving as a synonym *C. stantonensis* Jones, and others have applied *C. Hepburnii* to the plant of western America, excluding *C. nardina* altogether.

Here, then, the matter rested until Tengwall (Sv. Bot. Tidskr. **10**: 543. 1916), in reporting *C. Hepburnii* from northern Scandinavia, started a lot of trouble. Ostenfeld (Medd. om Grønl. **54**: 164. 1923), having carefully examined a large number of plants of what had heretofore been considered good *C. nardina* from arctic Europe and Greenland, decided that Tengwall was essentially right and that a number of plants from Lapland, Spitsbergen, Greenland, and N. E. America should be separated from *C. nardina;* but he concludes: "I feel it impossible to keep the two forms as distinct species." This is not surprising, since neither Tengwall nor Ostenfeld had seen specimens of true *C. Hepburnii,* and the plant they had in mind and which a number of subsequent writers have accepted as *C. Hepburnii* is actually *C. nardina* var. *atriceps* Kükenth. (in Rep. Sp. Nov. **8**: 7. 1910), based upon specimens from West Greenland; of this Kükenthal, l. c., says: "Diese Varietät steht zwischen der typischen Form und der nordamerikanischen var. *Hepburnii* (Boott) Kükenth." This very clearly is Tengwall's plant, of which the writer has a duplicate from the original collection and which Tengwall illustrates, l. c., *fig. 4* (left).

That *C. "Hepburnii"* of Tengwall and Ostenfeld cannot be maintained as specifically distinct from *C. nardina* has been made abundantly clear by Scholander (Skr. om Svalbard, No. **56**: 121. 1933, and **62**: 58–62. 1934), who even goes a step farther and, perhaps prejudiced by his personal experiences with the "false" *C. Hepburnii,* questions the existence of a "real" one. Having seen no authentic material of *C. Hepburnii,* he is not convinced by Mackenzie's treatment, l. c., and, after citing Mackenzie's key, concludes: "characteristics here enumerated [seem] to be extremely vague and in both instances very variable tendencies which are without any firm inter-coupling."

True *C. Hepburnii* is poorly represented in most herbaria; even in the Gray Herbarium there are but a few sheets. Therefore, in the absence of authentic material, it is easy to understand why so many recent writers, including Polunin, l. c., although he admits to having seen Scholander's treatment, have been misled by Tengwall and Ostenfeld. The two varieties of *C. nardina* may be distinguished thus:

	C. nardina and var. *atriceps*	var. *Hepburnii*
spike:	ovoid-orbicular	ovate-oblong
staminate part:	not conspicuous	conspicuous
pistillate scales:	dark, with pale midvein only	conspicuous light center
perigynia:	distinctly short-stipitate	tapering below, not conspicuously stipitate
sheaths:	gradually tapering into blade	abruptly contracted into blade

Distribution: *Carex nardina* and its var. *atriceps:* Extreme northern Europe, Spitsbergen, Iceland, E. and W. Greenland, eastern North America from Ellesmere Island south to Gaspé, Que., west to Hudson Bay and to mountains of western America; not in the Mackenzie District and probably not in Alaska. *Carex nardina* var. *Hepburnii:* Mountains of Alberta, British Columbia, and Washington, north to Alaska and ? Yukon; doubtful in Colorado.

Unfortunately the matter is still further complicated by the presence of still another species which has passed as *C. Hepburnii* but which is probably not even very closely related to it. This is the following species.

Carex elynaeformis sp. nov.

Dense caespitosa, rhizomate brevi ascendente; culmi erecti, tenues strictique, 15–20 cm. alti, obscure triangulares, valde canaliculati, glabri, folia aequantes aut parum superantes, pallide virides; vaginae annorum praecedentium diu persistentes filamentosiusculae, haud nitidae; folia numerosissima, setiformia, angustissima, stricta, canaliculata perconvoluta quapropter facie teretia, marginibus scaberrimis; spica solitaria, ebracteata, 1–1.3 cm. longa, androgyna interdum tota mascula, parte mascula valde conspicua linearisque, quam spica fere dimidio minor; utriculi 5 vel 6 adpressi-ascendentes; squamae orbiculares, obscure brunneae, margine pallido membranaceo, utriculi longitudine aequantes; utriculus plano-convexus vel compresse trigonus, 4–4.6 mm. longus, 1.3–1.5 mm. latus, stramineus apice obscurus, oblanceolatus, inferne in stipitem crassam desinens in rostrum brevem membranaceum contractam, marginibus superne scabris; nux facie lanceolata, valde trigona, circa 3 mm. longa; stigmatibus 3 (2).

Great Bear Lake: North shore of Smith Arm, Olmsted Bay, about 66° 32′ N., 122° 30′ W., sandy cutbanks, July 16–21, 1928, *5057* (type). A good match for the above is a plant in the National Herbarium of Canada, represented by three sheets: Colorado: Lake Creek, 12,000 ft., July 30, 1919, *I. W. Clokey 3403;* Mt. Elbert, 12,000 ft., July 20, 1919, *I. W. Clokey 3402;* Colorado Flora No. 4022, dry hills, Fall River Pass, Aug. 11, 1921, *I. W. Clokey et al. 3485,* (all distributed as *C. Hepburnii*).

Carex elynaeformis, by its prominent staminate part of the spike, approaches *C. filifolia* Nutt., but the scales are not papery white. From *C. nardina* and its var. *Hepburnii* it is abundantly distinct by its pale, conspicuously trigonous lanceolate achenes. In all *C. nardina* and its varieties the achenes are lenticular and of a very characteristic bluish gray colour. *Carex elynaeformis* appears to be another of the group of bicentric plants known only from high peaks of Colorado and from the northern Mackenzie District.

Carex chordorrhiza Ehrh.

Mackenzie River Delta: Richards Isl., *2182;* Kittigazuit, *2436;* Arctic Coast: Atkinson Pt., *2576;* Liverpool Bay, *2849;* Eskimo Lake Basin: 2nd lake, *2972;* Setidgi Lake, *3102;* Great Bear Lake: North shore, *5029;* Smith Arm, *5073;* McTavish Arm, *5260;* Keewatin Distr.: Lake on Tha-anne R., 60° 58′ N., 97° W., *5559;* west coast of Hudson Bay, 62° 5′ N., *5629;* Chesterfield, *6143;* Kazan R., Yathkyed Lake, *5761.*

Not uncommon from the Mackenzie Delta east to Hudson Bay, and north to a short distance beyond the tree limit. Not previously recorded from the Mackenzie District.

Carex diandra Schrank.

Great Bear Lake: McTavish Arm, *3702.*

Not previously known in the district from north of Great Slave Lake.

Carex disperma Dewey.

Mackenzie River Delta: Aklavik, *7303;* Great Bear Lake: McTavish Arm, *5339.*

New to the flora of the Northwest Territories.

Carex tenuiflora Wahlenb.

Mackenzie River Delta: Aklavik, *7304;* Eskimo Lake Basin: Setidgi Lake, *3132;* Great Bear Lake: McTavish Arm, *3619, 5262, 5343.*

Not previously known in the district from north of Great Slave Lake.

Carex norvegica Willd.

Eskimo Lake Basin: East of Mackenzie Delta, *2964.*

New to the flora of the Mackenzie District.

Carex neurochlaena Holm, in Am. Jour. Sci. **166:** 453. 1903, **167:** 301, 303. *f. 1, 2.* 1904.

Mackenzie River Delta: Kittigazuit Isl., margin of summer-dry creek, *2331;* Arctic Coast: 6 mi. east of Kittigazuit, rare in wet tundra, *2439;* Atkinson Pt., in dry *Carex*-bog some distance from coast, *2564;* Eskimo Lake Basin: North shore of 2nd lake, common in *Sphagnum*-bog, *2970;* Liverpool Bay, in a *Carex*-bog, *2851;* Great Bear Lake: North shore, *5031;* Cape McDonnel, *5115.* Somewhat rare or occasional, in dry tundra from the Mackenzie Delta east to Anderson River, south to Great Bear Lake.

Mackenzie (N. Am. Flora **18:** 90. 1931) has reduced *C. neurochlaena* to synonymy under *C. marina* Dewey (*C. glareosa* var. *amphigena* Fern.). With the abundant material now available this seems entirely unjustified. *Carex glareosa* as well as var. *amphigena* are true sea-shore plants, while *C. neurochlaena* is an inland plant. In the former two the culm is weak and generally decumbent, while in *C. neurochlaena* it is slightly curved, firm, and erect. Also in the latter the beak is slightly, but very characteristically, bent. *Carex neurochlaena* was previously known only from the type locality: Above Rink Rapids, Yukon R., *J. Macoun 53879* (Can). The type is annotated by Mackenzie: "*C. heleonastes.*"

Carex bonanzensis Britt.

This rare *Carex,* previously known from a few collections near the type locality (Bonanza Cr., Dawson, Yukon) and from E. Siberia, was found growing abundantly in wet places in a meadow in the Mackenzie River Delta, East Branch, 68° 40′ N., Aug. 6, 1933, *6879.* New to the flora of the Northwest Territories.

Carex leptalea Wahlenb.

Great Bear Lake: McTavish Arm, east shore, *3762;* southeast shore, *3618.*

Carex obtusata Liljebl.

Arctic Coast of Yukon Territory: *7124;* Richardson Mts.: West of Mackenzie Delta, *6641;* Mackenzie River Delta: East Branch, *6890, 7015;* Richards Isl., *2060;* Kittigazuit Isl., *2330;* 6 miles east of Kittigazuit, *2450, 2451;* Arctic Coast: Tuktuayaktoq, *7408;* Liverpool Bay, *2848;* Eskimo Lake Basin: Kugaruk, *3078;* Great Bear Lake: North shore, *4926, 4927;* Dease Arm, *4830.*

Common or occasional in sandy places east to Great Bear Lake. New to the flora of the Northwest Territories.

Carex deflexa Hornem.

Great Bear Lake: Dease River Valley, *4870;* McTavish Arm, southeast shore, *3644;* Keewatin Distr.: Tha-anne R., 60° 58′ N., 97° W., *5560.*

New to the flora of the Northwest Territories.

Carex concinna R. Br.

Mackenzie River Delta: East Branch, *6963;* Campbell Lake, *1891;* Richards Isl., *2058;* Eskimo Lake Basin: Setidgi L., *3137;* Great Bear Lake: Ft. Franklin, *3197, 3210;* Dease Arm, *4755.*

Carex rupestris All.

Mackenzie River Delta: Campbell Lake, *1892;* Richards Isl., *2178;* Arctic Coast: Atkinson Pt., *2582;* Cape Dalhousie, *2714;* Great Bear Lake: Cape McDonnel, *5117.*

An eastern type, rare or occasional in the Mackenzie District, and probably reaching its western limit near the Mackenzie River.

Carex glacialis Mackenzie.

Mackenzie River Delta: East Branch, *7016;* Campbell Lake, *1890;* Great Bear Lake: Dease Bay, *4732, 4793;* McTavish Bay, southeast shore, *3645;* Great Bear River, Mt. Charles, *3290;* Keewatin Distr.: Kazan R., Yathkyed L., *5766;* Tha-anne R., *5564.*

Rare or occasional in sandy and gravelly places.

Carex eburnea Boott.

Mackenzie River Delta: Campbell Lake, *1894;* Great Bear Lake: Great Bear River, Mt. Charles, *3289.*

Previously known in the Mackenzie District only from the type locality, Ft. Norman.

Carex rufina Drejer.

Typical specimens of this rare species, previously known only from Greenland and northern Norway, were collected in Keewatin District: Near the edge of a summer-dry pond on Tha-anne R., 60° 58′ N., 97° W., July 12–13, 1930, *5566.*

Mackenzie (N. Am. Flora **18**: 232. 1935) gives the distribution of *C. rufina* as: "High northern sections of Greenland, etc." This is erroneous, because *C. rufina* is not an arctic species. On the west coast of Greenland it reaches 69° 15′ N., but in most years at its northern limit it is unable to mature fruits. *Carex rufina,* although it forms pure stands, is a most inconspicuous species, easily overlooked because normally the flowering culms are completely concealed among the leaves.

Carex bicolor All.

Arctic Coast: 6 miles east of Kittigazuit, *2446, 2447;* Cape Dalhousie, *2716;* Great Bear Lake: Dease Arm, north shore, *4889;* Haldane R., *4918, 4919;* Smith Arm, north shore, *5058;* Keewatin Distr.: Lake on Tha-anne R., *5557;* Mistake Bay, *5628.*

Not previously recorded from the Mackenzie District.

Carex Garberi Fern.

Mackenzie River Delta: South end of Richards Isl., *7062;* north end, *2183;* Great Bear Lake: Great Bear River, *3264;* Dease Arm, *4792;* McTavish Arm, *3675, 5288, 5325.*

Not previously recorded from north of Great Slave Lake.

Carex livida Willd. var. **Grayana** (Dewey) Fern.

Eskimo Lake Basin: 2nd lake, 69° N., 132° 30′ W., *2965.*

Our specimens grew in a large stand in a wet meadow, and on Aug. 18, 1927, had mature fruit. New to the flora of the Northwest Territories and not before recorded from the Mackenzie basin.

Carex Williamsii Britt.

Mackenzie River Delta: North end of Richards Isl., *2173;* Arctic Coast: 6 miles east of Kittigazuit, *2448;* Liverpool Bay, *2845;* Eskimo Lake Basin: 2nd lake, *2968;* Keewatin Distr.: Kazan R., Yathkyed Lake, *5759.*

New to the flora of the Mackenzie basin.

Carex Oederi Retz. var. **pumila** (Cosson & Germ.) Fern.

Great Bear Lake: South shore, Leith Pt., *3530, 3558;* Cape McDonnel, *5126.*

Not previously recorded in the Mackenzie country from north of Great Slave Lake.

Carex petricosa Dewey.

Richardson Mts.: Eastern slope, west of Mackenzie Delta, alpine tundra, 2000–3000 ft., in beginning anthesis, *6647, 6648;* Arctic Coast: Liverpool Bay, 70° N., 129° W., dry edge

of a small tundra pond, fruiting specimens, Aug. 15, 16, 1927, *2840;* GREAT BEAR LAKE: North shore of Dease Arm, 67° 02′ N., 119° 50′ W., flowering specimens, June 23–27, 1928, *4676, 4887.*

This very striking species has been collected but a few times, all in the general vicinity of the type locality in the Canadian Rockies: Banff, July 14, 1900, *N. B. Sanson 25498* (Can); Mt. Rendle, 6000′, Aug. 7, 1902, *N. B. Sanson* (G); Banff, Aug. 4, 1891, *J. Macoun 7425* (Can). Our specimens are a close match for these. In some of the spikelets of our no. *2840,* a few perigynia have two instead of three stigmas.

Carex atrofusca Schk.

Common in not too dry tundra from mountains west of Mackenzie Delta to Hudson Bay, south to Great Bear Lake, where it is alpine or restricted to "barrens" and absent in wooded parts. As the writer has pointed out (in Rhodora **41**: 204. 1939), it is strange that this species, common throughout the "barren grounds," was not collected by Richardson, and that it has not previously been collected in the Mackenzie District.

Carex atrofusca Schk. var. **decolorata** var. nov.

A specie differt squamis anguste lanceolatis, cinnamomeis, nervo medio obscuro, utriculisque cinnamomeis basi nigro-purpurascentibus, 3.5–4 mm. longis; nuce 1.4 mm. longa.

GREAT BEAR LAKE: Cape McDonnel, low tundra, Aug. 2, 1928, *5120* (TYPE).

Carex rariflora (Wahlenb.) Sm. var. **androgyna** var. nov.

A specie differt spiculis terminalibus androgynis stigmatibus 2 nec 3.

ARCTIC COAST: Atkinson Pt., 70° N., 131° 20′ W., Aug. 1–3, 1927, *2579* (TYPE).

Carex limosa L.

ESKIMO LAKE BASIN: Setidgi Lake, *3135;* GREAT BEAR LAKE: McTavish Arm, north shore, *5220;* southeast shore, *3601.*

In the Mackenzie District not recorded from north of Great Slave Lake.

Carex paupercula Michx.

GREAT BEAR LAKE: McTavish Arm, north shore, *5221;* east shore, *3723.*

Not previously recorded in the Mackenzie District from north of Great Slave Lake. Mackenzie (N. Am. Flora **18**: 351. 1935) points out that *C. paupercula* Michx. is not to be confused with the South American *C. magellanica* Lam., which has "the terminal spike normally gynaecandrous." In our no. *5221* fully half of the terminal spikes are gynaecandrous.

Carex media R. Br. in Richardson in Franklin's Journ. App. 750. 1823.

Carex Vahlii Schk. var. *inferalpina* sensu Fernald in Rhodora **35**: 220–223, 398. 1935, non Wahlenb.

Carex angarae Steud. See Rhodora **41**: 203–205. 1939.

Common in the Mackenzie District, in the wooded parts, north to the Mackenzie Delta (Eskimo Lake Basin, Setidgi Lake, *3138*) and Great Bear Lake.

Carex norvegica Retz. Fl. Scand. Prodr. ed. 1. 179. 1779, non Willd.

Carex Vahlii Schk.

KEEWATIN DISTR.: West coast of Hudson Bay west to Kazan R., Yathkyed Lake, *5757, 6142.*

An eastern type not known west of the last-mentioned station.

Carex holostoma Drejer.

MACKENZIE RIVER DELTA: Richards Isl., *2181, 7064;* ARCTIC COAST: 6 miles east of Kittigazuit, *2442;* Cape Dalhousie, *2723;* Liverpool Bay, *2846;* GREAT BEAR LAKE: McTavish

Arm, east shore, *3711, 3722;* north shore, *5259;* fjords on the east shore, *5342;* KEEWATIN DISTR.: Kazan R., Yathkyed Lake, *5762;* Baker Lake, *6080;* Lake on Tha-anne R., *5561;* Mistake Bay, *5630;* Chesterfield, *6144.*

Although Polunin (l. c., 129) records this species as "new to North America, outside Greenland," the writer and his brother thirteen years earlier, in 1927, collected it from numerous stations in the Mackenzie District. *Carex holostoma* is a truly arctic species widely distributed in arctic parts of North America, from the Mackenzie R. east to central parts of West Greenland, south to the edge of the forest. It is absent in East Greenland and Iceland but has an isolated occurrence in northernmost Scandinavia. The illustration in Mackenzie, l. c., *tab. 414,* 1940, is very poor; a much better one is in Ostenfeld, Fl. Arct. *fig. 32.* 1902.

Carex stylosa C. A. Mey.

GREAT BEAR LAKE: Cape McDonnel, *5105A.*

Not previously recorded from the Northwest Territories.

Carex podocarpa R. Br. See Rhodora **41:** 205–206. 1939.

RICHARDSON MTS.: *6645, 6646, 6763, 6764, 6766, 6767;* ARCTIC COAST: West of Mackenzie Delta, *6903, 7090.*

Common in mountains west of the Mackenzie Delta, north to the arctic coast, on snow-flushes and in herb mats.

Carex nesophila Holm.

RICHARDSON MTS.: Eastern slope, west of Mackenzie Delta, 4000′ elev., *6644.*

New to the flora of the Northwest Territories.

Carex atrosquama Mackenzie.

GREAT BEAR LAKE: Smith Arm, north shore, *4991;* Keith Arm, Deerpass Bay, *3457;* Etacho Pt., alpine meadows, *3476.*

Rare or occasional in meadows in the Paleozoic country about the west end of the lake. New to the flora of the Northwest Territories.

Carex albo-nigra Mackenzie.

MACKENZIE RIVER DELTA: East Branch, 68° 55′ N., *7017;* ARCTIC COAST: East of Mackenzie Delta, *2583A;* GREAT BEAR LAKE: Cape McDonnel, *5104;* McTavish Arm, north shore, *5289.*

In rather wet tundra. New to the flora of the Northwest Territories.

Carex Buxbaumii Wahlenb.

GREAT BEAR LAKE: South shore, Leith Pt., *3532, 3566.*

Typical specimens were found on wet shores of a limestone island. New to the flora of the Northwest Territories.

Carex Morrisseyi sp. nov.

Rhizomata longa tenuia non-stolonifera; culmi solitarii aphyllopodici tenues erecti, 20–35 cm. alti, acutanguli superne scabri; folia plana, circa 3 mm. lata, marginibus scabris, revolutis, aeque ac culmi cinereo-viridia, culmo dimidio breviora; spiculae 3 vel 4 valde approximatae, sessiles vel inferior breviter pedunculata, mascula (vel rarissime androgyna) terminalis linearis vel lineari-clavata, 10 mm. longa, laterales 2 vel 3 foemineae, ellipsoideo-obtusae, 10–12 mm. longae, densiflorae; bractea inferior setacea quam spicula multo brevior, evaginata; squamae foemineae ovatae vel ovato-cuspidatae (nunquam aristatae) nigrae, nervo medio pallido prominente (squamae masculae longiores angustioresque, obscure castaneae); utriculi squamas superantes, ovato-ellipsoidei subcompressi cinereo-virides superne distincte papillosi, 3 mm. longi, brevissime stipitati, in rostrum brevissimum fauce integro abrupte contracti; stigmata brevia 3 (aliquando 2); nux obovata sessilis, trigona, 2 mm. longa, in stylum brevem contracta.

Wet, marshy places on pre-Cambrian rock from Labrador coast to Great Bear Lake.

Labrador: Cutthroat Harbor, south of Cape Mugford, 57° 30′ N., 62° W., low granite island, Aug. 26, 1937, Bartlett Greenland Expedition, 1937, *A. E. Porsild 173* (type); Okkak, near Cutthroat Tickle, 57° 40′ N., 62° W., Aug. 12–14, 1937, *V. C. Wynne-Edwards 7523;* Keewatin Distr.: Yathkyed Lake on the Kazan R., 62° 30′ N., 97°–98° 30′ W., Aug. 1–15, 1930, *5775;* Mackenzie Distr.: Great Bear Lake: McTavish Arm, Conjuror Bay, 65° 50′ N., 117° 15′ W., Aug. 15, 1928, *3674;* Cape McDonnel, low tundra and lake shore, Aug. 2, 1928, *5105;* north shore, *4991A.*

Carex Morrisseyi commemorates Captain Robert A. Bartlett's schooner Effie M. Morrissey, veteran of numerous arctic voyages. It belongs in the section *Atratae* Kunth and admittedly is closely related to *C. Buxbaumii* Wahlenb. (*C. polygama* auctt., non Gmel., fide Mackenzie), of which polymorphous species var. *heterostachya* Anders. also has the terminal spikelet staminate ("spicula terminalis mere ♂") ; but it is certainly abundantly distinct from all American forms of that species.

Carex Buxbaumii of Europe has recently been revised by Cajander (Ann. Bot. Soc. Zool.-Bot. Fenn. **5**: 5. 1935), who divides the species into several subspecies and varieties and who reports that plants with staminate terminal spikelets are not rare in Fennoscandia. He assumes (under *C. polygama* ssp. *alpina* (Hartm.) Cajander) that Hartman "with his γ *heterostachya* by and large had in mind specimens belonging just with this subspecies" (translated from Cajander's German text, l. c. 22).

Carex polygama ssp. *alpina,* however, is described and illustrated with a gynaecandrous terminal spikelet, and, while in Scandinavia staminate terminal spikelets may occur in all "forms" of the collective species, in our plant this is the rule. Thus, at the type locality, in a large colony, but three specimens could be found in which the terminal spikelet was androgynous and none that were gynaecandrous. Also in our plant the spikelets are more densely aggregate and but rarely with the lowermost spikelet somewhat remote; moreover it appears to have a distinct sub-arctic geographical range of its own. Intermediate forms between it and *C. Buxbaumii* have never been observed, nor have variations in *C. Buxbaumii* ever been recorded from North America having other than "oblong-ovoid gynaecandrous" terminal spikelets.

Carex anguillata Drejer in Revis. Crit. Car. 454. 1841; Steudel in Syn. Pl. Cyp. 214. 1855; Fl. Dan. **16**: *tab. 2846.* 1871.

Great Bear Lake: Smith Arm, north shore, *4988;* Cape McDonnel, *5114, 5109;* McTavish Bay, north shore, *5172;* Keewatin Distr.: Kazan R., Yathkyed L., *5767, 5774;* Tha-anne R., *5565;* Chesterfield, *6146.*

Carex anguillata has been referred by Boott to *C. aquatilis* var. *minor,* whereas by most other writers it is placed with *C. rigida* Good. Both interpretations seem unsatisfactory in view of the long-peduncled, long- and lax-flowered pistillate spikelets, although there can be little doubt that the affinity is with the latter.

Fernald, in Rhodora **36**: 91. 1934, drew attention to Drejer's *C. anguillata,* almost forgotten since Kükenthal (l. c., 302) reduced it to an unimportant form of *C. concolor* R. Br., citing specimens from Iceland and from Labrador (*A. P. Low 13459,* Can). Fernald suggested its presence in Greenland and Maine, while Mackenzie, l. c., cited material also from Hudson Bay and Keewatin.

Carex anguillata seems amply distinct from *C. concolor* and is not rare in S. Greenland, Labrador, and Keewatin, west to Great Bear Lake. It grows in sandy well-drained soil, where it forms a loose turf. The specimens cited above from the writer's collection are fairly typical.

Carex concolor R. Br. seems to be absent in continental parts of N. America west of Hudson Bay.

Carex lugens Holm. See Mackenzie in N. Am. Flora **18:** 401. 1935, excl. *C. consimilis* Holm; also, Porsild in Rhodora **41:** 208. 1939.

Arctic Coast of Yukon Territory: *7088, 7126;* Richardson Mts.: *6642A, 6643, 6765;* Mackenzie River Delta: East Branch, *6537, 6957, 6990, 6991, 7017A;* Campbell Lake, *1893;* south end of Richards Isl., *2059, 2064, 2065, 7063;* north end of Richards Isl., *2164, 2175–2177;* Kittigazuit, *2325;* Arctic Coast: East of Delta, *2444;* Eskimo Lake Basin: 2nd lake, *2963.*

The above series is rather uniform; most numbers have a few staminate flowers at the apex of the lateral spikelets. *Carex lugens* is a common species in Alaska, Yukon, and Northwest Mackenzie District east to Keewatin. It grows in old, well-established tundra where it forms large, compact tussocks.

Carex consimilis Holm in Am. Jour. Sci. **166:** 457. 1903, **167:** 310. 1904.

Besides the type the following specimens, all in the National Herbarium of Canada, are typical: Yukon Territory: Lake Kluane to Don Jek R., *A. Müller,* Aug. 11–27, 1920; Mackenzie Delta: Kittigazuit, *2323;* Arctic Coast: East of Mackenzie Delta, *2443;* Atkinson Pt., *2583;* Cape Dalhousie, *2730;* Liverpool Bay, *2853;* Great Bear Lake: North shore, *4922;* Cape McDonnel, *5103, 5128A;* Keewatin Distr.: Kazan R., Yathkyed Lake, *5772.*

This species has been placed by Mackenzie, l. c., under *C. lugens* Holm, but the type (*John Macoun 53878,* Can) differs so much from *C. lugens* in its strong, horizontal rhizomes, the short and broad leaves and stout culms, etc., that this interpretation is most unsatisfactory. Moreover, there is in the writer's collection a series of plants that completely match the type as well as the description. Lacking the dense, caespitose habit of *C. lugens,* these plants, in the field, had been tentatively labelled *C. concolor* for lack of a more satisfactory name, although it was even then realized that true *C. concolor* is absent in continental parts of North America west of Hudson Bay and that our plant, moreover, differs consistently from it by its short, oval-oblong, almost black, contiguous spikelets. *Carex consimilis* grows in dry peaty places in lowland tundra.

Carex aquatilis Wahlenb.

Common in the Mackenzie valley north to the Arctic Ocean and east to Great Bear Lake, chiefly in alluvial soils along the north-flowing rivers. It is a truly boreal, though not at all an arctic species, which in the delta of the Mackenzie reaches slightly beyond the limit of trees. Along the Mackenzie it forms extensive meadows and in the delta it is one of the principal sources of native hay.

Carex stans Drejer, Revis. Crit. Car. 458. 1841; Fl. Dan. **14:** *tab. 2477* (poor). 1849; Steudel, Syn. Pl. Cyp. 210. 1855; Lange, Consp. Fl. Groenl. 147. 1880.

Carex aquatilis var. *stans* (Drejer) Ostenf. Fl. Arct. 70, *fig. 43.* 1902.

Carex aquatilis var. *minor* Boott, Carex **4:** 163, *tab. 545* (good). 1867.

Carex stans differs from *C. aquatilis* in its shorter and stouter culms, which are nearly always longer than the leaves; the latter are flat, or the margins may be slightly involute, generally broader, never conduplicate or glaucous as in *C. aquatilis.* The sheath of the lower bract is more loosely clasping and generally black-auricled. The staminate spikelet is solitary (rarely 2); the pistillate ones are shorter and thicker than in *C. aquatilis.* Perigynia tend to be slightly longer, stramineous rather than green, and often dark-tipped, smooth, under a lens not conspicuously punctate; scales somewhat longer, often equaling the perigynia, dark brown or even black with a pale mid-vein (much darker than in *C. aquatilis*).

Carex stans in its distribution is truly arctic. That it is not merely an arctic form or race seems amply proved by the fact that in W. Greenland it reaches south only to lat. 68° and is absent on the east coast south of 76°. South of these latitudes it is not replaced by *C. aquatilis,* which appears to be wanting in Greenland.

Polunin, l. c., 132, records *C. aquatilis* from the eastern Canadian Arctic, but mentions "intermediate" forms between that species and "var. *stans.*" Polunin probably did not understand *C. aquatilis,* and all records of that species from the eastern Arctic should be changed to *C. stans.*

Distribution: Arctic-circumpolar (except Iceland); across N. America, and southward almost to the limit of trees.

Carex salina Wahlenb.

Mackenzie River Delta: North end of Richards Isl., *2166, 7448;* Eskimo Lake Basin: Kugaruk, *3080.*

Our plant is intermediate between typical *C. salina* Wahlenb. and *C. subspathacea* Wormskj., but it is a much coarser plant than the latter. It is *C. salina α stricta* Drejer (in Revis. Crit. Car. Bor. 452. 1841), which Kükenthal reports from the Bering Sea (*Macoun 16619*), and probably also *C. Hopnerii* Boott (in Hook. Fl. Bor.-Am. **2**: 219. *tab. 220.* 1839). Also it is a near match for specimens from the Bering Sea referred by Hultén to *C. Ramenskii* Kom. (Rep. Sp. Nov. **13**: 164. 1914). Typical *C. subspathacea* Wormskj., in America, seems to be an eastern arctic species, on the arctic coast reaching west to Dolphin and Union Strait (*Can. Arct. Exp. 341, 378,* Can).

Carex microglochin Wahlenb.

Great Bear Lake: North shore, Haldane R., *5032;* Cape McDonnel, *5127;* McTavish Arm, north shore, *5171.*

Not previously recorded from the Mackenzie District.

Carex physocarpa Presl.

Mackenzie River Delta: East Branch, *6989;* Aklavik, *3183;* Kittigazuit Isl., *2322;* Arctic Coast: 6 miles east of Kittigazuit, *2441;* Atkinson Pt., *2570, 2571;* Cape Dalhousie, *2724;* Eskimo Lake Basin: 2nd lake, *2967.*

A western arctic species common in Alaska and Yukon, eastward to the Mackenzie Delta, and in the alpine Rocky Mountains to the south. All records from east of the Mackenzie River and east of the Rocky Mountains no doubt should be referred to *C. saxatilis* L. Compare also Polunin, l. c., 136.

Carex saxatilis L.

An eastern arctic species, the N. American distribution of which includes E. & W. Greenland, N. Labrador, Baffin Isl., and the country from Hudson Bay west to Lake Athabaska and Great Bear Lake.

Carex membranacea Hook.

One of the most common and most truly arctic sedges, abundant from Alaska to northern Labrador and south to the limit of trees. It is strange that it has not reached Greenland.

Carex rotundata Wahlenb.; Hook. Fl. Bor.-Am. **2**: 220. 1839, Bear Lake record only; Mackenzie, N. Am. Flora *tab. 518.* 1940, not as to text and distribution (**18**: 454. 1935); Gray's Man. ed. 7. 255, *fig. 552,* excl. distr.

Mackenzie River Delta: North end of Richards Isl., *2163;* Eskimo Lake Basin: North shore, 2nd lake, *2971;* Great Bear Lake: ? Fort Enterprise, *Richardson.*

Mackenzie, l. c., appears to have been misled by writers on the flora of Greenland, including Ostenfeld in Fl. Arctica, who have confused *C. rotundata* with *C. saxatilis*. Why this should be is not easy to understand, because *C. rotundata* is a clear-cut and well-marked species. It is well-described and illustrated in Gray's Man., l. c., from a typical specimen in the Gray Herbarium labelled: "*C. rotundata* Wahl. dedit Wahl. from I. Br. herb." Mackenzie's plate also is very good.

Carex rotundata Wahlenb. is an arctic Eurasian species which enters N. America in Alaska and northwest Mackenzie. It is a very rare plant in American herbaria, where most plants so-named should be referred to *C. saxatilis* or to *C. membranacea*. Although for a hundred years it has been recorded from Greenland by most authors on that flora, the present writer has never, in many years of collecting in that country, been able to satisfy himself as to the authenticity of Greenland material thus named. Recently Sørensen (Medd. om Grønl. **101**[3]: 122. 1933, **101**[4]: 83. 1934) has voiced such doubt, stating simply that, by comparison with authentic Scandinavian material, all Greenland specimens previously called *C. rotundata* are referable to *C. saxatilis*. With this view the writer is in complete accord.

Carex oligosperma Michx.

Although Richardson collected this species on Great Bear Lake, the writer did not see it there. It was collected recently on the Yellowknife R., 63° 30′ N., 111° W., by J. Carroll (*8*, Can).

LEMNACEAE

Lemna trisulca L.

Mackenzie River Delta: East Branch, 68° 40′ N., *7375;* Aklavik, 68° 12′ N., 135° W., flowering sparingly in a shallow lake, Sept. 1, 1934, *7305;* lake between delta and Eskimo Lakes, 68° N. (fragments in muskrat "push-up" on the ice), Nov. 2, 1933, *6932*.

Lemna trisulca in the Mackenzie basin was previously known north to Lake Athabaska and the Wood Buffalo Park, 60° N. (*Raup*), and the above numbers, therefore, represent a considerable extension of the known range.

ARACEAE

Calla palustris L.

Mackenzie River Delta: Lake on the portage trail between Campbell and Setidgi Lakes, about 68° N., 133° W., rhizomes with young leaves, June 16, 17, 1927, *2023;* Eskimo Lake Basin: Creek above Setidgi L., plants with mature fruit, Aug. 24, 1927, *3175;* tundra lake between delta and Eskimo Lakes, fragments from muskrat "push-up," Nov. 2, 1933, *6933;* Mackenzie River: Lake near Sans Sault Rapids, 65° 40′ N., Sept. 20, 1928, *3400*.

Calla palustris was previously known north to Great Slave Lake (*Raup*). The above numbers represent a considerable extension of the known range.

LILIACEAE

Tofieldia nutans Willd. See Porsild in Rhodora **41**: 213. 1939.

Mackenzie River Delta: Husky R., in a muskeg, *6779*.

New to the flora of Canada.

Lloydia serotina (L.) Reichb.

Richardson Mts.: West of Mackenzie Delta, rare in alpine tundra, *6653;* Arctic Coast of Yukon Territory: King Pt., *7130*.

Alaska-Yukon east to Mackenzie R. New to the flora of the Northwest Territories.

Smilacina stellata (L.) Desf.

GREAT BEAR LAKE: Great Bear R., Foot of Mt. Charles, *3310.*

New to the flora of the Northwest Territories.

ORCHIDACEAE

Cypripedium parviflorum Salisb.

MACKENZIE RIVER: Bear Rock at Ft. Norman, *3381;* GREAT BEAR LAKE: Great Bear River, Foot of Mt. Charles, *3291, 3326;* west shore, 65° 30′ N., *J. M. Bell 22974* (Can).

New to the flora of the Northwest Territories.

Cypripedium guttatum Sw.

MACKENZIE RIVER: Ft. Norman, *G. Hume 103449* (Can).

Not previously recorded in our region from north of Great Slave Lake (*Raup*).

Orchis rotundifolia Pursh.

MACKENZIE RIVER DELTA: Campbell Lake, *1983;* GREAT BEAR LAKE: McTavish Arm, east shore, *3622, 3763;* southeast shore, *5296;* Leith Pt., south shore, *3576.*

Not previously recorded from north of Great Slave Lake.

Habenaria obtusata (Pursh) Richards.

Common in the Mackenzie region north to the limit of trees, occasional or rare for a short distance beyond. The known north limit is on the Arctic Coast: 6 miles east of Kittigazuit, *2461.*

Goodyera repens (L.) R. Br.

MACKENZIE RIVER: Sans Sault Rapid, *6561.*

Previously recorded from Great Bear Lake by Richardson.

Listera borealis Morong.

MACKENZIE RIVER DELTA: East Branch, *6576, 7280;* GREAT BEAR LAKE: Keith Arm, Ft. Franklin; south shore, Leith Pt., *3539;* Bear R., *3361.*

Previously known on the Mackenzie northward only to Ft. Simpson.

Corallorrhiza trifida Chat.

MACKENZIE RIVER DELTA: Husky R., *6654;* Aklavik, *6575;* East Branch, *6540;* Campbell Lake, *1984, 1985;* Richards Isl., *2190;* ARCTIC COAST: 6 miles east of Kittigazuit, *2460;* GREAT BEAR LAKE: Bear R., *3275;* McTavish Arm, *5227, 5294, 5294A, 5327;* Dease Arm, *4681, 4733, 4892;* Keith Arm, Russel Bay, *3409;* Etacho Pt., *3486;* south shore, Leith Pt., *3537, 3575;* MACKENZIE RIVER: Root R., 62° 30′ N., *6273;* KEEWATIN DISTR.: Mistake Bay, 62° 05′ N., *5648.*

Fairly common in the Mackenzie District, north to the limit of trees or a short distance beyond. Not previously recorded from north of Great Slave Lake or from Keewatin District.

SALICACEAE

When pushing his way for endless, weary miles through unmapped, pathless "bushland" of the Northwest Territories, in winter by dog team or on snowshoes, in summer on foot or by canoe, the writer was always reminded of the dictum of that great student of North American willows, who said: "We know, however, almost nothing of the *Salix* flora of the woodland region of the Northwest Territories, which must be an Eldorado for willows" (C. Schneider in Bot. Gaz. **66**: 340. 1918).

The writer now regrets that before going into the North he was unable to prepare himself adequately for the study of the willows in the field. Although in the Northwest Territories he collected a total of 35 species, represented by

235 collections aggregating about 1000 sheets, he realizes that too often the collecting of critical species was done in a haphazard way and without sufficient notes. The willow collection has been named and studied by the Swedish salicologist, Dr. B. Floderus. Pending the publication of Dr. Flöderus' notes the following distributional data on the more interesting species are given.

Salix arbusculoides Anders.

One of the most common willows of the lower Mackenzie valley, represented by several series of collections. In the Mackenzie Delta, north of the continuous spruce forest, it forms dense thickets and "willow islands" 10–15 feet high, and in the forest it often forms the principal "underbrush" with tree-like bushes 15–20 ft. high. North of Great Bear Lake and in the Keewatin District it reaches a short distance beyond the tree limit, where it was collected along Kazan R. at Yathkyed L., *5789*.

Salix arbutifolia Pall.

Salix fuscescens Anders.

Arctic Coast of Yukon Territory: Shingle Pt., *7093;* Mackenzie River Delta: East Branch, *6955;* Arctic Coast: East of Mackenzie, *2467, 2589, 2590, 2866, 2976;* Keewatin Distr.: Kazan R., *6025*.

New to the flora of Canada.

Salix arctophila Cockerell.

A common species in wet tundra north of the forest. Although apparently an eastern species, it extends across the continental Northwest Territories from Hudson Bay to the Arctic Coast west of the Mackenzie Delta (*7091, 7172*).

Salix candida Flügge.

Great Bear Lake: Bear R., *3251*.

Although it was recorded by Richardson as occurring "throughout the wooded country," the writer saw this species but once.

Salix Chamissonis Anders.

Richardson Mts.: Grassy slopes in the foothills, 1500', *6781, 7329*.

This rare willow, previously known only from the Bering Sea region, is new to the flora of Canada.

Salix glauca L. var. **acutifolia** (Hook.) Schneid. in Bot. Gaz. **66**: 327. 1918.

Salix Seemannii Rydb.

Mackenzie River Delta: Limestone scree, Richardson Mts., *6783;* East Branch, *7250, 7253;* Campbell Lake, *1904;* Arctic Coast of Yukon Territory: King Pt., *7131;* Great Bear Lake: Keith Arm, *3410, 3411;* McTavish Arm, north shore, *5263*.

This is a common and most variable shrub, in our region chiefly on Paleozoic formations or at least with a preference for calcareous soil.

Salix fullertonensis Schneid.

This eastern species, previously recorded westward only as far as Coronation Gulf, proved very common on "barrens" along the shores of Great Bear Lake, *4685, 4686, 4687, 5135, 5136, 5138A, 5653*.

Salix glacialis Anders. See Schneider in Bot. Gaz. **67**: 63–64. 1919.

This rare willow, known only from a few places in Alaska, was collected on a sandy beach near Shingle Pt., Y. T., *7094*. New to the flora of Canada.

Salix herbacea L.

Great Bear Lake: Dease Valley, *4874;* Keewatin Distr.: Kazan R., Yathkyed L., *5787;* Lake on Tha-anne R., *5560A;* west coast of Hudson Bay, Mistake Bay, *5650*.

This eastern species, which has not previously been collected west of Hudson Bay, is within its range ubiquitous in herb-mats and on snow-flushes. Its scarcity in the interior may be due in part to the aridity of the climate and consequent lack of suitable stations.

Salix hudsonensis Schneid.

An eastern species, with a distribution pattern somewhat similar to that of *S. fullertonensis,* collected by us on Great Bear Lake, *5138B,* and on the Arctic Coast west to the Mackenzie Delta (numerous collections). Previously recorded by Schneider westward to Coronation Gulf.

Salix lingulata Anders. See Schneider in Bot. Gaz. **66**: 353. 1918.

Arctic Coast of Yukon Territory: King Pt., *7173;* Mackenzie River Delta: East Branch, *7366;* Campbell Lake, *1986;* Kittigazuit, *2468* (× *niphoclada*); Great Bear Lake: North shore, *4688A and B, 4689.*

Salix niphoclada Rydb. See Schneider in Bot. Gaz. **66**: 339. 1918.

Arctic Coast: Liverpool Bay, *2861, 2862;* Great Bear Lake: Cape McDonnel, *5137;* Great Bear R., Mt. Charles, *3327.*

This little-known willow, the type of which came from the lower Mackenzie River, appears to be fairly common in the Paleozoic country of the northwestern Mackenzie District.

Salix nivalis Hook. var. **saximontana** Rydb.

Keewatin Distr.: Lake on Tha-anne R., *5574.*

According to Floderus (in litt.) this is represented in our collections by this single number.

Salix pedicellaris Pursh var. **hypoglauca** Fern.

Keewatin Distr.: Lake on Tha-anne R., in a *Carex* bog, *5573.*

Represented in the collection by this single number. New to the flora of Keewatin.

Salix phlebophylla Anders.

Vaccinium caespitosum sensu Holm & Macoun in Rept. Can. Arct. Exp. **5A**: 18. 1921, not Michx.

This tiny Alaskan willow is rare on dry tundra ridges in the Caribou Hills east of the Mackenzie Delta: East Branch, *7263;* Kittigazuit, *2469.* Also there is a single collection from Richardson Mts., west of Mackenzie Delta, *O. Bryant 6581.* The first and only previous collection from Canada was made at Herschel Island, Y. T., by the Canadian Arctic Expedition, but recorded by Macoun & Holm, l. c., as *Vaccinium caespitosum.*

Salix pulchra Cham.

One of the most common willows in the Mackenzie Delta, where it grows in alluvial soil, often with *S. arbusculoides.* It has tentatively been referred by Floderus (in litt.) to *S. pulchra* var. *yukonensis* Schneid. *Salix pulchra* is common in Alaska and in the Yukon and was recorded by Ostenfeld (in Gjöa Exp. 35) from the Arctic Coast west of the Mackenzie Delta. One collection from Richardson Mts., west of the Mackenzie Delta, *7328,* also seems to belong to the species.

MYRICACEAE

Myrica Gale L.

Very common and represented by numerous collections from Great Bear Lake, where it had been collected previously by Richardson. Apparently rare in the

Mackenzie River Delta (Campbell Lake, *1901*) and in Keewatin District (Lake on Tha-anne R., *5526*).

BETULACEAE

Betula microphylla Bunge.

Mackenzie River Delta: West Branch, *O. Bryant 6584;* East Branch, *7465;* Setidgi Lake, *3143;* Great Bear Lake: McTavish Arm, *5229, 5230.*

Rare or occasional from the Mackenzie Delta east to Great Bear Lake. In the Mackenzie Delta, *B. microphylla* is a small tree rarely more than 12 feet high, quite unlike *B. papyrifera* in shape and foliage. The leaves turn fully two weeks earlier than those of the latter.

Betula papyrifera Marsh. var. **neoalaskana** (Sarg.) Raup.

According to Dr. Hugh M. Raup, who has kindly examined the birches in the writer's collection, this appears to be the common tree-like species of the Mackenzie Delta, the lower river, and Great Bear Lake. The paper birch is rare in the low parts of the Delta but on the higher east and west banks, and on Bear Lake, it reaches a height of about 30 feet, with trunks 8 inches in diameter. On the East Branch it does not extend quite as far north as the spruce (*Picea glauca*).

Betula papyrifera Marsh. var. **occidentalis** Sarg.

Mackenzie River: Bear Rock, near Fort Norman.

In the Mackenzie Basin outside the mountains not previously recorded from north of Lake Athabaska.

POLYGONACEAE

Koenigia islandica L.

Keewatin Distr.: Lower Kazan R., 97° W., *6026* (new western limit).

While Polunin, l. c., states that this plant is circumpolar and Hultén (Fl. Kamtchatka 2: 42. 1928) gives its American distribution as "along the Arctic Coast to Baffin Land," the fact remains that it has never been collected between the Seward Peninsula in Alaska and the Keewatin District.

Rumex acetosa L.

Richardson Mts.: West of Mackenzie Delta, *6656, 6786.*

New to the flora of the Northwest Territories.

Rumex pallidus Bigel.

Mackenzie River Delta: Aklavik, occasional on sandy river banks, *7300;* East Branch, *7299, 7307;* Richards Isl., *2075;* Kittigazuit, *2472.*

Polygonum alpinum All. var. **lapathifolium** Cham. & Schlecht.

Mackenzie River Delta: East Branch, *6502, 7295;* Peel River, *Miss E. Taylor 73* (Can).

Our plant is probably "*P. alpinum* γ foliis ovato-acuminatis glaberrimis. . . . Arctic Sea-coast, *Dr. Richardson,*" in Hooker, Fl. Bor.-Am. 2: 131, although it actually does not reach north beyond the limit of trees in the Mackenzie Delta. It is taller and more robust than the plant of the Bering Sea region and perfectly glabrous. It is best developed in ravines on the East Branch, where, on the freshly exposed calcareous clay of recent landslides, it forms pure stands of an acre or more in extent. Here the plant may grow 5 or 6 feet high, with 50 or more stems from one root. The shoots are edible when young and are used locally as rhubarb.

CHENOPODIACEAE

Suaeda maritima (L.) Dumort.

Chenopodium maritimum L., Hook. Fl. Bor.-Am. **2**: 126. 1838.

Arctic Coast: Atkinson Pt., *2605;* Great Bear Lake: North shore of McTavish Arm, near mineral spring, *5193.*

PORTULACACEAE

Montia lamprosperma Cham.

Polunin, l. c., suggests that this is circumboreal, but actually, like *Koenigia islandica,* it appears to be absent between the western tip of Alaska and the west coast of Hudson Bay.

CARYOPHYLLACEAE

Arenaria arctica Stev.

Apparently common in mountains west of the Mackenzie Delta and along the arctic coast of the Yukon Territory. Richardson's "Shores of the Arctic Sea," in Hook. Fl. Bor.-Am. **1**: 100, no doubt, refers to the latter place. We never collected it east of the delta nor at Great Bear Lake, although it was collected once in the latter place by *J. M. Bell* in 1900 (*22887,* Can). A still more puzzling collection is that of *A. P. Low,* Northern Labrador (Ungava), Aug. 1897 (*18258,* Can).

Arenaria dawsonensis Britt.

Great Bear Lake: Dease Arm, *4805;* north shore, *5078;* McTavish Arm, *3779, 5269, 5298.*

Common on the pre-Cambrian east shore of the lake.

Arenaria humifusa Wahlenb.

Mackenzie River Delta: Campbell Lake, *1911;* Great Bear Lake: Smith Arm, *4997;* McTavish Arm, *3766;* south shore, Leith Pt., *3578;* Keewatin Distr.: Kazan R., *6027;* Yathkyed L., *5793.*

Arenaria laricifolia L.

Richardson Mts.: West of Mackenzie Delta, *6797.*

New to the flora of the Northwest Territories.

Arenaria macrocarpa Pursh.

Arctic Coast of Yukon Territory: King Pt., *7134A, 7174,* rare or occasional. Thus far not recorded from east of the Mackenzie.

Arenaria nardifolia Ledeb.

Mackenzie River Delta: East Branch, *7269;* Richards Isl., *2079, 2206;* Kittigazuit, *2481;* Arctic Coast: Atkinson Pt., *2598;* Liverpool Bay, *2872;* Great Bear Lake: Dease Arm, *4835;* Smith Arm, *4999, 5076;* McTavish Arm, *3624.*

Common in dry places eastward to Great Bear Lake.

Arenaria obtusiloba (Rydb.) Fern.

Richardson Mts.: West of Mackenzie Delta, *6795;* Mackenzie River Delta: Campbell Lake, *1912, 1989;* East Branch, *7267, 7268.*

New to the flora of the Northwest Territories.

Arenaria Rossii R. Br.

Richardson Mts.: West of Mackenzie Delta, *6659, 6792, 6793A;* Arctic Coast: Dolphin & Union Strait, Young Pt., *C. A. E. 367B* (as *Sagina* sp.); Bernard Harbor, *C. A. E. 267* (as *Alsine verna* Bartl. var. *rubella* (Wahlenb.) Lange, Macoun & Holm in Rept. Can. Arct. Exp. **5A**: 12. 1921).

Arenaria sajanensis Willd.

Richardson Mts.: West of Mackenzie Delta, *6794, 7333* (western limit); Great Bear Lake: Numerous collections; Keewatin Distr.: Kazan R., *5794;* Tha-anne R., *5575.*

An eastern species, apparently common west to the Mackenzie. New to the Mackenzie District.

Arenaria uliginosa Schleich.

GREAT BEAR LAKE: Smith Arm, *5077;* Cape McDonnel, *5140;* McTavish Arm, *3655;* KEEWATIN DISTR.: Kazan R., *5759A, 6629;* Mistake Bay, *5661.*

New to the Mackenzie and Keewatin Districts.

Cerastium alpinum L.

Contrary to some writers who have stated that *C. alpinum* is circumpolar, in North America it appears to reach west only to the 120th meridian, where it is replaced by *C. Beeringianum* Cham. & Schlecht.

Cerastium arvense L.

MACKENZIE RIVER DELTA: Campbell Lake, *1987; Stringer 14257, 62271* (Can); GREAT BEAR LAKE: Dease Arm, *4803.*

New to the flora of the Northwest Territories.

Sagina intermedia Fenzl.

ARCTIC COAST OF YUKON TERRITORY: *7099;* MACKENZIE RIVER DELTA: Kittigazuit, *2482;* ARCTIC COAST: Cape Dalhousie, *2747.*

New to the flora of the Mackenzie District.

Sagina nodosa (L.) Fenzl.

GREAT BEAR LAKE: McTavish Arm, *5175;* KEEWATIN DISTR.: Baker Lake, *6119.*

New to the Mackenzie and Keewatin Districts.

Silene repens Patr. in Pers. Syn. **1:** 500. 1805.

Silene purpurata Greene, Pitt. **2:** 229. 1892.

RICHARDSON MTS.: West of Mackenzie Delta, *6791;* MACKENZIE RIVER DELTA: East Branch, *7026;* Richards Isl., *2085, 7068, 7270;* ESKIMO LAKE BASIN: *3028.*

Silene repens is rare or occasional in sandy places east to the Eskimo Lakes. It is one of the few truly western species that have crossed the Mackenzie River. New to the flora of the District.

Melandrium (Wahlbergella)

Much has been written in the past, by students of arctic plants, on the taxonomic status of this notoriously critical genus and its members, and it is not without a feeling of presumption that the writer embarks upon a treatment of the American arctic and boreal members of the group. While in the eastern American Arctic the problems, if not simple, at least are limited to a few species, in the far Northwest matters become more complicated and the writer finds that he cannot conscientiously "lump" the numerous entities found there with the apparently still insufficiently understood "eastern" or circumpolar species.

Although most American authors (except Rydberg) maintain *Melandrium* (*Wahlbergella*) in the somewhat heterogeneous or "roomy" genus *Lychnis,* the writer, without offering any new argument in favour of the admittedly slight distinguishing features, prefers to follow the European authors who, with few exceptions, have long maintained *Silene, Melandrium, Viscaria, Lychnis,* and *Agrostemma* as separate genera in the tribe Lychnideae. A. T. Tolmatchev (Trav. Mus. Bot. Acad. Sci. U. R. S. S. **24.** 1932) has given what appears a most satisfactory treatment of the genus in Eurasia, and in Komarov's Fl. U. R. S. S. (**6:** 714–723. 1936) he has treated the Section *Gastrolychnis,* giving what seem workable keys and descriptions of 13 species occurring in the Soviet Union.

From the discussion in some recent papers (Polunin, l. c., 180–186; Th. Sørensen, Medd. om Grønland **101**[3]: 26–33. 1933; P. Gelting, ibid. **101**[2]: 47. 1934), it would appear that even the long-known East American species of *Melandrium* are not well-understood. Due to the numerous edaphic or ecological variations so common in this genus, herbarium material especially is not always easy to interpret if mature seeds are lacking. The writer is very familiar with *M. affine, M. triflorum,* and *M. apetalum,* which, in West Greenland, at the Danish Arctic Station at Godhavn, he has grown from seed and observed for many years in cultivation as well as in the field. He has also seen and studied the genus in the field from Labrador to Alaska. From mountains of the west he has seen the material of *Melandrium* in the Gray Herbarium and in the National Herbarium of Canada, but, lacking field experience with the genus in the Rocky Mountains, he prefers to limit the following treatment to the arctic and subarctic plants.

While it is realized that some ecological or edaphic forms, if without mature seeds, may not fit into the following key, it is offered, nevertheless, in the hope that it may be of service in all but extreme cases.

An excellent key to *M. affine, M. triflorum,* and *M. apetalum* is given by Abromeit in Bibl. Bot. **8** [Heft 42[2]]: 15. 1899.

Key to Melandrium in arctic North America

A. Seeds large, 1.5–2.4 mm. across, with conspicuously inflated wing; calyx, at least in anthesis, conspicuously inflated.

B. Seeds 1.8 mm. or over; calyx much inflated; petals barely exserted.

C. Flowers solitary (very rarely two), nodding throughout anthesis and erect only when capsule is mature; calyx thin, papery, dark purple, puberulent, glutinous, almost globular; petals purple (wet places: circumpolar, arctic) ..... *M. apetalum.*

C. Flowers 1 or 2, lateral, long-peduncled; calyx pubescent, urceolate; petals pale rose (alpine gravelly slopes, Norton Sd., Alaska) ..... *M. macrospermum.*

B. Seeds less than 1.8 mm. across; petals much exserted, 1½ to 2 times as long as the calyx.

D. Perennial; stems erect, stiff, often purplish above, 15–25 cm. high; cauline leaves linear-obtuse, smaller than the basal leaves; calyx mostly dark purple, urceolate in fruit, 1–1.6 cm. long and 0.6–0.8 cm. in diam.; petals milky white (circumpolar, arctic) ..... *M. affine.*

D. Short-lived perennial; stems green throughout, slender, more or less fractiflexed at the nodes, 30–50 cm. high; cauline leaves well-developed, attenuate; flowers few, long-peduncled; calyx green, campanulate, in fruit 0.6–0.8 cm. long, 0.6–0.7 cm. in diam.; petals rose; seeds small, cuneate, with a narrow wing (riverbanks; Yukon—Mackenzie R.) ..... *M. Taylorae.*

A. Seeds small, 1 mm. or less in diam., wingless; calyx in anthesis scarcely or at least not conspicuously inflated.

E. Fruiting calyx cylindric, with green nerves; inflorescence many-flowered, the flowers on long, conspicuously appressed pedicels; plant tall, stiffly erect (plains: Sask.—Rocky Mts., north to Mack.) ..... *M. Drummondii.*

E. Fruiting calyx urceolate; inflorescence few-flowered.

F. Seeds cordate or reniform in outline, strongly tuberculate; stems robust, erect-ascending, mostly dark purple above; flowers sessile or very short-peduncled (endemic of Greenland) ..... *M. triflorum.*

F. Seeds angular, more or less prismatic, merely granulate or rugose; stems erect, green throughout, rather weak; basal leaves soon withering; flowers pedunculate (Mackenzie Delta—Arctic Coast; Siberia) ..... *M. taimyrense.*

E. Fruiting calyx narrowly campanulate; seeds somewhat lustrous, dark brown, granulate at least on the dorsal side; stems ascending, 1- to several-flowered (dry limestone ledges; endemic of Great Bear Lake) ..... *M. Ostenfeldii.*

Melandrium apetalum (L.) Fenzl in Ledeb. Fl. Ross. **1**: 326. 1842.

Lychnis apetala L. Sp. Pl. 437. 1753; Fl. Dan. **5**: *tab. 806.* 1781.

Lychnis montana Wats. in Proc. Am. Acad. **12**: 247. 1877.

Lychnis attenuata Farr in Contr. Bot. Lab. Pa. **2**: 419. 1904.

Lychnis nesophila Holm in Rep. Sp. Nov. **3**: 338. 1907.

To the full discussion recently given by Polunin (l. c., 184–186), the writer has little to add beyond that *M. apetalum,* unlike the other species, is invariably found in moist places, such as wet tundra, moist meadows, or even in grassy places bordering brackish lagoons, in wet moss by alpine streams, or in wet clayey places on moraines almost to the snow line. The flowers are solitary, or very rarely there is a weakly developed second flower from the upper node, nodding in anthesis and erect only when the capsules open. The stems are weak and often somewhat flexuous. It is so well-marked that confusion with other species seems scarcely possible. Simmons (Phytogeogr. Arct. Am. Arch. 84. 1913) and later Polunin, l. c., have pointed out that *L. nesophila* Holm is merely an extreme and abnormal variation. *Lychnis montana* Wats. and *L. attenuata* Farr seem very near *M. apetalum* (L.) Fenzl. The first is said to have the flowers erect or slightly nodding in anthesis; the latter seems scarcely distinguishable.

Distribution: Common across arctic North America, south to the tree line, north to Ellesmere Island; high mountains of Alta., B. C., and Yukon; W. Greenland south to Disco Bay; E. Greenland south to Scoresby Sound.

General Distribution: Circumpolar (not in Iceland), arctic-alpine.

Melandrium macrospermum A. E. Porsild in Rhodora **41**: 225, *tab. 552, fig. 1–3.* 1939.

Known thus far only from the type locality: Alaska: Norton Sound, volcanic hills back of Unalaklet, *A. E. & R. T. Porsild 1147.*

Melandrium affine J. Vahl in Fl. Dan. **14**: 5. 1843.

Melandrium pauciflorum (Ledeb.) Ostenf. in Medd. om Grønl. **65**: 173. 1923, nomen confusum.

Lychnis affinis J. Vahl in Fries, Mant. **3**: 36. 1842; Fl. Dan. **13**: *tab. 2173.* 1836 (sub nom. *L. triflora*).

Lychnis furcata Fern. in Rhodora **34**: 22. 1932, non *Viscago furcata* Raf. Autikon Botanikon 28. 1840.

Lychnis affinis Fries, Polunin, Bot. Can. E. Arct. 183. 1940.

Lychnis ? Kingii Wats. in Proc. Am. Acad. **12**: 247. 1877.

Lychnis triflora Sommerf. in Mag. f. Naturv. **2**[1]: 151. 1824, non R. Br.

Rafinesque, l. c., in 1840, described a plant from "Labrador and Hudson Bay" under *Viscago furcata,* which Fernald, l. c., takes to be *Melandrium affine* J. Vahl (1843), and for which he substitutes the combination *Lychnis furcata* (Raf.) Fern. to cover the plant of Greenland and N. America (but not that of Europe). Rafinesque's plant, however, cannot have been a *Lychnis* (*Melandrium*), for Rafinesque, according to Fernald, l. c., says: "Remarkably like the last plant [*Physocarpon vespertinum* Raf., based upon *Lychnis vespertina* Sibth.], but a real Silene not dioical and with 3 styles, smaller 4 to 6 inches high, calix and petals shorter, incarnate." Rafinesque's plant then is a true *Silene* and not a *Melandrium,* nor a *Lychnis* in the restricted sense (*Gastrolychnis*), both of which have five styles.

Fernald's second suggestion that Vahl's plant from Greenland (and also that of N. America) differs from Fries' plant from Scandinavia seems hardly tenable in the light of more detailed historical data. This history is briefly as follows (notes kindly supplied by Dr. Morten P. Porsild).

Lychnis triflora was mentioned by name (Ross' Voy. Disc. App. p. 142. 1819), but not properly described, by Robert Brown, from poor material from N. W. Greenland. The Norwegian botanist, S. C. Sommerfeldt, in 1824, described a plant under that name collected at Godhavn, Greenland, by his friend Schwabe, Governor of North Greenland, taking it to be Robert Brown's plant because its 3-flowered inflorescence suggested this and because it was clearly not one of the two species of *"Lychnis"* (*Melandrium apetalum* and *Viscaria alpina*) then known from Greenland. *Melandrium* (*Lychnis*) *triflorum,* however, does not grow at Godhavn proper, where Schwabe most likely made his collection, whereas *M. affine* is very common there. Sommerfeldt's plant is undoubtedly *M. affine,* and the first unequivocal description of true *M. triflorum* was by J. Vahl in Fl. Dan. (1843). Jens Vahl, from 1828 to 1832, traveled extensively in S. W. Greenland, where he had been specifically instructed by Hornemann to secure materials for Flora Danica. But not until 1833, when Vahl came to North Greenland, did he see any *Melandrium.* At Godhavn he at once collected what he also thought was Brown's *"Lychnis triflora,"* and a beautiful plate of this plant was in due course published under that name by Hornemann, Fl. Dan. **13**: *tab. 2173.* 1836. When Vahl visited the east coast of Disco Island and the Nugssuaq Peninsula, he realized that there was still another plant which at last was the real *"Lychnis triflora"* of Brown. The Godhavn plant which had been illustrated in Flora Danica (*tab. 2173*) erroneously as *Lychnis triflora,* was by Vahl (in his unpublished manuscript and field notes preserved in Copenhagen) then called *"affine,"* thereby suggesting a close "affinity." Later, in 1843, J. Vahl himself published and edited Fl. Dan. (*tab. 2356*), showing the true *Melandrium triflorum* (R. Br.) J. Vahl, and correcting the earlier mistake in a footnote which reads: "Obs. L. triflora Fl. Dan. *t. 2170* [obviously a misprint for *2173*] est Melandrium affine J. Vahl msc. (seminibus—reticulatis marginatis, marginibus inflatis)."

Lange (Nomenclator Fl. Dan. 137. 1887) later repeated this correction. Vahl did not then redescribe the plant, which, in his field notes in Greenland, he had called *"affine,"* because his friend Elias Fries (Mantissa **3**: 36. 1842) had already done it for him the year before.

From 1838 to 1839, J. Vahl joined Gaimard's Expedition to Spitsbergen. He left the expedition in 1839 at the small town Bosekop in Alten Fiord (Finmark District of northern Norway), where he spent some time before returning to Copenhagen. Here, on the banks of Alten River, Vahl rediscovered his new species of *Melandrium* from Greenland, and specimens from his collection are in the Copenhagen herbarium. While at Bosekop, Vahl undoubtedly met the botanist Laestadiŭs, who was a missionary or minister to the Laps, and who lived and worked not far from there. He already knew Vahl's plant and had named it *Lychnis Dorothea* in honour of its original local collector, Vahl's hostess at Bosekop, Madame Dorothea Klerck. Part of Laestadius' type, which he gave to Vahl, is in Copenhagen and bears the following inscription on the label: "Lychnis Dorothea. Florens Alten Mad. Klerck legit. Obs. an vera Lychnis affinis tua est? Si habes parva specimina mittas. Tue Lychnis affinis habet calicem valde inflatam."

The plants cited by Elias Fries, l. c., therefore, are those collected "ad Alten Finmarkiae" by Laestadius and J. Vahl, not by his father Martin Vahl as suggested by Fernald, l. c. Martin Vahl's journey to Lapland took place in 1787–88, and he died on December 24, 1804, at Copenhagen (See O. Dahl, in Nyt Maga-

zin f. Naturvidensk. 59. 1921). Fries maintained a close correspondence with both Laestadius and J. Vahl and it was clearly his intention to describe J. Vahl's plant. His citation of J. Vahl's "Fl. Gr. Msc." proves that Fries accepted the latter's view that the plant of Greenland and Lapland belonged to the same species rather than that he (Fries) made a "misidentification of the Greenland plant of J. Vahl" (Fernald, l. c.).

The writer is unable to see any consistent differences between the plant of northern Scandinavia and that of Greenland and N. America. Except in the seed character, *M. affine* is subject to variations according to habitat. The differences given by Fernald, l. c., in his comparative description of *Lychnis furcata* and *L. affinis* are not very large and all seem to be within the normal range of variation in this species. The seeds illustrated by Fernald (*figs. 5* and *6*) vary somewhat in shape, but in size, texture, and width of wing they are really quite alike. *Figure 3,* showing a flowering calyx from Torne Lapmark, is not typical *M. affine* but probably *M. affine* ssp. *angustiflorum* (Rupr.) Tolm.

Fernald's suggestion that the plant of N. Scandinavia is distinct from that of Greenland and N. America is further weakened by the fact that Polunin, l. c., reports, under *Lychnis affinis* Fries, a plant collected by him on the west coast of Hudson Bay (Churchill), "inseparable from examples of this species gathered in northern Scandinavia, as Professor Fernald was kind enough to confirm for me." The Churchill plant, of which the writer, in 1930, collected abundant material, and of which he has seen several other collections, approaches *M. Taylorae* (Robins.) Tolm. in its small, greenish-striped fruiting calyces and in the exceptionally well developed cauline leaves, but its seeds are indistinguishable from those of *M. affine*. Near it, on drier ground, grew typical *M. affine*.

Melandrium affine is normally found in not too wet sandy or gravelly places near the seashore, on lake and river banks, and on rocky ledges. It does rather well in cultivation and responds generously to fertilizers.

Distribution: Rare or occasional in northern Alaska and on mountains of the interior; common across arctic Canada, south to the tree-line, north to Ellesmere Isl.; in mountains of western United States (*"Lychnis Kingii* Wats.") and Canada; common in west Greenland south to 65° 38′ N., and on the east coast south to 69° 30′ N.

General Distribution: Circumpolar (not in Iceland), arctic-alpine.

Melandrium Taylorae (Robins.) Tolmatchev in Trav. Mus. Bot. Acad. Sci. U. R. S. S. **24:** 267. 1932.

Lychnis Taylorae Robins. in Proc. Am. Acad. **28:** 150. 1893.

Lychnis affinis sensu Polunin, Bot. Can. E. Arct. 183. 1940, non Fries.

To Robinson's short but very clear description it may be added that *M. Taylorae,* unlike the other species treated here, is a "short-lived perennial" which generally dies after the second flowering. The weak, fractiflexed or "zig-zag" stem, as well as the calyx, are viscid with short, glandular hairs; the basal leaves are lanceolate, short-petiolate, glabrate to almost glabrous except for the soft ciliation of the margins; the stem leaves are well-developed and attenuate. The lower flowers are borne on long peduncles and are nodding when young; the capsule is very short, less than 1 cm. long, and almost as wide. The seeds are small, triangular or wedge-shaped in outline, with a narrow but distinct wing, wrinkled but not granulate or tuberculate.

Melandrium Taylorae, by its very short capsules, long fruiting peduncles, and the very characteristic seeds, is well-distinguished from *M. affine*. Polunin, l. c., who had perhaps seen only the type (a poor specimen), or who had been

misled by Ostenfeld, who annotated it "*L. paucifloral* Ledeb." without giving his reasons, reduced it to synonymy under *L. affinis* Fries.

Mackenzie River Delta: Dry slopes, Peel River, July 15, 1892, *Miss E. Taylor* (type, G), *2647* (isotype, Can); north end of Richards Isl., *2212;* south end of Richards Isl., *2084;* Arctic Coast: Tuktuayaktoq, *7418;* Mackenzie River: Arctic Red River, *Dutilly 16* (G); Great Bear Lake: Etacho Pt., 1500′ elev., *3492;* Bear River, *3266;* Yukon Territory: Klondike River, *John Macoun 58402* (Can), distr. as *Lychnis triflora* var. *Dawsoni* Robins.; Coal Creek Hill, *F. Funston 81* (G, US); Bonanza Creek, *A. Eastwood 195,* distr. as *L. triflora* (G); Alaska: Kowak R., N. Alaska, *McLennan,* in 1884 (G); Eagle Camp (centr. Alaska), *E. Scamman 699* (G); International Boundary, 65° 30′ N., 141° W., *Mertie 35* (US).

General Distribution: Arctic Coast from N. W. Alaska to a short distance east of the Mackenzie Delta, south to Great Bear Lake, lower Mackenzie River, Central Yukon and Alaska. *Melandrium Taylorae* generally grows in sandy or loamy soil on river and lake shores, or sometimes in rather dry meadows or in open copses.

Melandrium Drummondii (Wats.) comb. nov.

Lychnis Drummondii Wats. in Bot. King Exp. 37. 1871.

? Silene Drummondii Hook. Fl. Bor.-Am. **1**: 89. 1830.

Distribution: Prairies and plains from Manitoba to British Columbia and southward, north to Lake Athabaska.

Melandrium triflorum (R. Br.) J. Vahl, Fl. Dan. **14**: *tab. 2356.* 1843.

Lychnis triflora R. Br. in Ross' Voy. Disc. App. 142. 1819.

Vahl's brief but very lucid description and the beautiful plate in Fl. Dan., l. c., show that this plant is abundantly distinct from *M. affine,* and the difficulty experienced by some investigators, e. g., Sørenson, l. c., in E. Greenland may indicate that true *M. triflorum* is rare there. As far as the writer is aware, all records from America have proved erroneous, and he agrees with Simmons (Vasc. Pl. Ellesmereland 126. 1906), notwithstanding Polunin, l. c., that *M. triflorum* must still be considered an endemic of Greenland. *Melandrium triflorum* is related to *M. Ostenfeldii, M. Drummondii,* and *M. taimyrense* in the West.

Distribution: W. Greenland south to 65° 40′; E. Greenland south to 70° 30′.

Melandrium taimyrense A. Tolmatchev in Trav. Mus. Bot. Acad. Sci. U. R. S. S. **24**: 264, *fig. 7.* 1932.

Stems strict, simple or branching, erect, hoary-villous, 16–25 cm. high. Leaves linear, about 6 cm. long, somewhat obtuse, canescent-hirsute. Flowers mostly 2 to 4, rarely solitary, calyx dark-lined, covered with grandular white hairs. Corolla white (or pale rose?), slightly longer than the calyx, the petals emarginate. Seeds rugose, somewhat granulate, yellowish brown (the writer's translation from the original).

The writer has seen an isotype, from Taimyr Peninsula, 74° 50′ N., 106° E., Aug. 13, 1928, *A. Tolmatchev 765* (in Herb. M. P. Porsild). It is in fruit and is perfectly matched by fruiting specimens in the writer's collection. To Tolmatchev's description it may be added that the flowering calyx is narrow, about half as wide as long, much smaller and narrower than in *M. affine* or *M. triflorum.* The petals of the flowering plant, of which Tolmatchev apparently did not have material, are actually considerably exserted. The young plants are gray, hoary-canescent with a short, dense pubescence. The basal leaves tend to become glabrescent in age and often wither even before the capsules open.

Mackenzie River Delta: Limestone hills N. of Campbell Lake, *1913;* Campbell Lake Seagull Cliff, dry gravelly limestone slopes, *1988;* East Branch, dry riverbanks, *7025,* Arctic Coast: 6 miles east of Kittigazuit, wet clay, *2475;* Atkinson Pt., *2597;* Cape Dal

housie, *2744;* Great Bear Lake: North shore of Dease Bay, *4691;* Keewatin Distr.: West branch of Thelon R., 63° N., July 5, 1900, *J. W. Tyrrell 23143* (Can).

Distribution: Sandy and gravelly places, from the Mackenzie Delta east to Thelon R., south to the north shore of Great Bear Lake.

General Distribution: Taimyr Pen., N. W. Siberia; Arctic, Mackenzie and Keewatin.

Melandrium Ostenfeldii sp. nov.

Herba caespitulosa e radice multicipite crassa ascendens, innovationibus numerosis sterilibus rosulatis; culmi 20–30 cm. alti, tenues, plus minusve divaricati aut ascendentes, nodis saepe geniculati, foliorum paribus 1 vel 2, saepius diminutorum, facie lineari-obtusa praediti, pubescentia brevi glandulosa in toto vestiti; folia basalia lineari-spathulata aut sublanceolata dense breviter pubescentia, adulta glabrescentia, petiolis diu persistentibus; flores 1–8, plerumque 3 vel 4, erecti vel pedunculis subdivergentibus fulti; calyx campanulatus, 1 cm. brevior, glanduloso-viscosus, viridis cum lineis subobscuris purpurascentibus; petala alba quam calyce dimidio majora; semina minima, 0.8 × 0.6 mm. aut minora, angularia, subnitida, castanea, conspicue granulosa.

Great Bear Lake: Dease Arm, Narakay Isl., 66° 45′ N., 119° 30′ W., rocky ledges of diabase, Aug. 1, 1928, *A. E. & R. T. Porsild 4839* (type); foot of Dease Arm, mouth of Dease R., *4802;* north shore, mouth of Haldane R., *5036;* McTavish Arm, east shore, *3777;* McTavish Arm, N. E. Fjord, *3676;* McTavish Arm, foot of Edna Travers Bay, *5218;* McTavish Arm, north shore, *5233;* south entrance to Conjuror Bay, *3623.*

Melandrium Ostenfeldii is known thus far only from pre-Cambrian rocks of the east shores of Great Bear Lake, where it is common on acid diabase and granite cliffs. It differs from *M. taimyrense* by its narrowly campanulate fruiting calyx and by its well-developed radical leaves that persist through the fruiting stage. It is no doubt related to *M. triflorum,* but, like that in *M. taimyrense,* the flowering calyx is much narrower and the seeds are smaller and granulate rather than tuberculate.

Stellaria calycantha (Ledeb.) Bong.

Mackenzie River Delta: East Branch, *6541, 7266;* Eskimo Lake Basin: Setidgi Lake, *3144, 3178;* Great Bear Lake: Keith Arm, *3465;* Etacho Pt., *3489;* McTavish Arm, *3894;* north shore, *5232.*

Somewhat rare, due to scarcity of suitable habitats, north to the limit of trees or slightly beyond.

Stellaria crassifolia Ehrh.

Represented by many numbers in the writer's collection, from Herschel Island to the west shore of Hudson Bay. Near its northern limit on the Arctic Coast, *S. crassifolia,* perhaps normally, does not produce fruit but is propagated by winter buds. New to the flora of the Mackenzie District.

NYMPHAEACEAE

Nuphar variegatum Engelm.

Eskimo Lake Basin: Setidgi Lake, *3704,* fruiting abundantly; McTavish Bay, east shore, *3704.*

Previously known in our region north to Great Bear Lake, where it is fairly common.

RANUNCULACEAE

Caltha natans Pall.

Keewatin Distr.: Lake on Tha-anne R., 60° 58′ N., 97° W., *5502.*

New to the flora of the Northwest Territories.

Anemone narcissiflora L.

Richardson Mts.: West of Mackenzie Delta, *6588, 6665, 6807, 7334.*

Common in alpine meadows above the timber line. New to the flora of the Northwest Territories.

Ranunculus acris L. var. **frigidus** Regel.

Ranunculus occidentalis Nutt. var. *robustus* Gray, Ostenf. in Gjöa Exp. 46. 1909; Macoun & Holm in Rept. Can. Arct. Exp. **5A:** 13. 1921.

Richardson Mts.: *6591, 6810,* above the timber line.

Common along the Arctic Coast and in mountains west of the Mackenzie Delta. Our plant is 20–30 cm. high and perfectly glabrous except just below the flower. The flowers are very large, 2 to 3 cm. in diameter; the petals are obovate and very shiny. The achenes are large with a prominently hooked, persistent style.

Ranunculus circinatus Sibth.

? Ranunculus subrigidus Drew in Rhodora **38:** 39. 1936.

Mackenzie River Delta: East Branch, 68° 40′ N., in 2–3 feet of water, *7248.*

The writer is unable to find any characters wherein the American plant differs from that of the Old World. The flowers, which are larger than in *R. trichophyllus* Chaix, are emerged during anthesis. Also it is later-flowering than that species. In the Mackenzie Delta it does not flower or mature fruit except in favorable seasons. New to the flora of the Northwest Territories.

Ranunculus gelidus Karelin & Kirilow in Bull. Soc. Bot. Mosc. **15:** 133. 1842.

For complete nomenclature of this rare plant see Ostenf. in Gjöa Exp. 44. 1909. To the synonyms given there should be added *R. Grayi* Britton, in Bull. Torr. Bot. Cl. **18:** 265. 1891, based upon *R. pedatifidus* Hook. Fl. Bor.-Am. **1:** 18, *tab. 8B.* 1829, non Sm.

The Gjöa Expedition collection came from King Point on the Arctic Coast of Yukon Territory. Abundant material was collected on the Richardson Mts.: West of Mackenzie Delta, 68° N., 136° W., on alpine peak, 4000′ elev., *6666.*

Ostenfeld, l. c., has shown that the plant so well-described and illustrated by Hooker, l. c., from specimens collected by Drummond in the Canadian Rockies, cannot be kept apart from Karelin & Kirilow's plant from the Alatau Mountains of Central Asia. In his recent treatment, Benson (in Bull. Torr. Bot. Cl. **68:** 657. 1941) apparently has overlooked Ostenfeld's discussion, and he maintains the plant under *R. Grayi,* stating that it is related to *R. Eschscholtzii.* The writer again is inclined to agree with Ostenfeld, who states that it belongs "to the *auriconus*-group, as also *R. affinis* and *R. pedatifidus.*"

Our specimens grew in moist gravel with *Douglasia arctica.* On July 10th the achenes were mature and but a single flower remained. The petals are small, 4–5 mm. long, pale yellow, and barely exceeding the sepals. The flowering stems are 6–10 cm. high, somewhat arcuate; the peduncles are villous. The leaves are glabrous and glaucous, the old leaf-bases persistent and strongly fibrous, as are the strongly developed roots. The achenes are glabrous, light green, 2 to 2.4 mm. in diam., orbicular, flattened; the style is lateral, short-hooked, not at all as figured by Hooker's *Fig. 1,* drawn from immature material.

Ranunculus Pallasii Schlecht.

Arctic Coast of Yukon Territory: Shingle Pt., *6905;* Mackenzie River Delta: North end of Richards Isl., *2218;* Arctic Coast: Tuktuayaktoq, *7419;* Atkinson Pt., *2612;* Liverpool Bay, *3104;* Eskimo Lake Basin: *2985, 3104.*

Common in wet brackish marshes along the Arctic Coast east to Anderson River, often together with *Hippuris vulgaris*. The very showy, pure white or pale rose flowers are very fragrant. The plants blossom throughout the season, and flowers and mature fruits may be seen together. It seems very strange that such a keen observer as Richardson failed to observe this very conspicuous plant. It is unrecorded from Canada west of Hudson Bay, but it is common in arctic parts of Alaska.

Ranunculus trichophyllus Chaix var. **eradicatus** (Laestad.) Drew.

Mackenzie River Delta: Very common; Kittigazuit, *2489;* Eskimo Lake Basin: *3179;* Great Bear Lake: North shore, *5038;* Dease Arm, *4695;* McTavish Arm, *5270;* Keewatin Distr.: Kazan R., *6036.*

The var. *eradicatus* seems always to prefer deeper water than var. *typicus*. In the Mackenzie Delta and at Great Bear Lake it was often observed to form a dense growth, flowering and fruiting abundantly, on the bottoms of lakes 10 to 12 feet deep. The flowers barely open and may be cleistogamous. In rapids of the Kazan River, in water 4 to 8 feet deep, it was likewise observed to flower and fruit.

Ranunculus trichophyllus Chaix var. **hispidulus** Drew.

Great Bear Lake: McTavish Arm, north shore, in a shallow, marshy slough, *5299.*

Ranunculus trichophyllus Chaix var. **typicus** Drew.

Mackenzie River Delta: East Branch, *6919;* Eskimo Lake Basin: North shore of 2nd lake, *2983, 2984.*

Much less common than var. *eradicatus* and perhaps restricted to shallow, calcareous lakes.

PAPAVERACEAE

Papaver alaskanum Hultén.

Rare or occasional along the Arctic Coast east to Cape Bathurst. In most of the collections the flowers are sterile, i.e., the anthers are well-developed but the ovary is abortive. Where fertile flowers occur the immature capsules are frequently eaten by ground squirrels (*Citellus parryi*).

Papaver microcarpum DC.

Richardson Mts.: West of Mackenzie Delta, alpine tundra, above timber line, *6669, 6813–6815* (the last is f. *albiflora*); Arctic Coast of Yukon Territory: King Pt., *7179;* Shingle Pt., *Can. Arct. Exp. 180* (distr. as *P. nudicaule* L.); Mackenzie River: Ft. Norman, *G. Hume 103443* (Can).

Papaver microcarpum is apparently common in the mountains of Yukon Territory but does not reach east of the Mackenzie.

Papaver radicatum Rottb.

Great Bear Lake: Cape McDonnel, *5143;* McTavish Arm, north shore, *5235;* east shore, *3781.*

Papaver radicatum is the common species of eastern Arctic America and the Arctic Archipelago. It reaches west to Great Bear Lake and Cape Bathurst. West of Great Bear Lake it is replaced by the closely related *P. alaskanum,* which may perhaps be considered a western race. (See Porsild in Rhodora **41**: 230–231, 1939).

CRUCIFERAE

Subularia aquatica L.

Great Bear Lake: McTavish Arm, *3696;* Keewatin Distr.: Lake on Tha-anne R., 60° 58′ N., 97° W., *6176.*

New to the flora of the Northwest Territories.

Thlaspi arcticum sp. nov.

Thlaspi montanum sensu Hook. Fl. Bor.-Am. **1**: 58. 1830, non L.

Thlaspi alpestre L. var. *purpurascens* Ostenf. in Gjöa Exp. 47, *tab. 3. fig. 17.* 1910, quoad spec., non *T. purpurascens* Rydb. in Bull. Torr. Bot. Cl. **28**: 281. 1901.

Herba perennis, radice in caudice multicipite ramoso terminata; folia basalia subglauca, carnea, glabra, spathulata, integra, in petiolum laminae aequilongum sensim fastigiata, 1–2.5 cm. longa, 0.5–0.8 cm. lata, nervo medio prominente, nervis lateralibus inconspicuis; culmi floriferi singuli aut pauci, glabri, in anthesi 3–5 cm. alti, maturi valde elongati, 10–18 cm. alti; folia caulina 3–5, linearia, sessilia, basi truncata; inflorescentia capitata 2–25-flora, fructifera valde elongata, pedicellis valde divaricatis, longitudine siliquas aequantibus; petala alba, circa 4.5 mm. longa, unguiculata, nervosa, sepalis viridescentibus duplo longiora; filamenta brevia crassaque, antherae breves ellipsoideae; siliquae maturae 6–7 mm. longae, 2–2.5 mm. latae, subcurvatae, cuneato-clavatae, exalatae, obtusae vel apice subacutae, haud emarginatae, valvis valde carinatis; stylus filiformis, circa 1 mm. longus; septum incompletum scissura magna longitudinali instructum; seminibus 1.5–2 mm. longis, 0.8–1 mm. latis, levibus, brunneis.

Arctic coast and foothills west of Mackenzie Delta, west to Herschel Island.

Arctic Coast of Yukon Territory: Kay Pt., 69° 12′ N., 138° 30′ W., very rare on dry tundra ridges, July 23–25, 1934, *A. E. Porsild 7144* (type); King Pt. (about 138° 30′ W.), June 20–28, 1906, *Gjöa Exp.* (Copenhagen, Can); Herschel Isl., 69° 35′ N., July 18, 1906, *Gjöa Exp.* (Copenhagen); same place, 1893, *I. O. Stringer 14257* (Can), distributed as *Arabis lyrata* L. var. *ambigua.* Our specimens are in fruit, while those of the Gjöa Expedition are in anthesis.

Ostenfeld, l. c., suggests that the Gjöa Exp. plant is *T. purpurascens* Rydb., from high mountains of Colorado and Arizona. He reduces it to a variety of the European *T. alpestre,* which, however, as already pointed out by Rydberg, l. c., is not indigenous to North America. Furthermore, *T. alpestre* is not perennial; Thellung (in Hegi, Ill. Flora v. Mitteleuropa 4[1]: 122) says of it: "Plant mostly bi- or triennial and, having once flowered it dies" (translation of Thellung's German text). *Thlaspi arcticum,* as well as all native *Thlaspi* of the Rocky Mountains, is perennial. In his revision of the genus, Payson (Univ. Wyom. Publ. Bot. **1**: 6. 1906) cites Hooker's Fl. Bor.-Am. but not Ostenfeld, l. c., and makes no reference to the arctic plant, nor does he appear to have seen specimens of it. *Thlaspi arcticum* differs from *T. purpurascens* and other related species by its much shorter style and few-leaved flowering stems; it is perhaps most closely related to *T. cochleariforme* DC., of mountains of western Siberia. One sheet in the Nat. Herb. of Canada: "Montes uralenses polares (lat. bor. 65° et 66° 30′), July 17, 1926, B. Gorodkov," distr. by Herb. Inst. Bot. Acad. Sci. U. R. S. S., differs from *T. arcticum* by the marcescent old leaf-bases, puberulent flowering stems, and the barely elongated fruiting raceme.

Rorippa obtusa (Nutt.) Britt.

Mackenzie River Delta: East Branch, riverbanks and meadows, *7225.*

New to the flora of the Northwest Territories.

Thellungiella salsuginea (Pall.) O. E. Schulz.

Sisymbrium salsugineum Pall. in Ledeb. Fl. Alt. **3**: 145. 1831.

? Turritis diffusa Hook. Fl. Bor.-Am. **1**: 41. 1829.

A single collection of what appears to be this rare species was made on the Arctic Coast, east of the Mackenzie, Liverpool Bay, *2891.* Our plant is apparently annual; it has clasping stem-leaves and entire radical leaves.

Cardamine digitata Richards. in Franklin's Journ. App. 743. 1823; Hook. Fl. Bor.-Am. 1: 45. 1829, excl. pl. Bering Str.; Macoun & Holm in Rept. Can. Arct. Exp. 5A: 14. 1921; Holm, ibid. 5B: 37. 1922.

Cardamine hyperborea Schulz in Bot. Jahrb. 32: 550. 1903, pro min. parte; Ostenf. in Gjöa Exp. 48. 1909; Simmons, Phytogeogr. Arct. Am. Arch. 91. 1913; Polunin, Bot. Can. E. Arct. 231. 1940. See Porsild in Trans. Roy. Soc. Can. 3rd. ser. sect. V, 32: 31–32. 1938.

When Schulz, l. c., united the genus *Dentaria* Tourn. with *Cardamine* Tourn., because of *Dentaria digitata* Lam., it became necessary to rename *Cardamine digitata* Richards. But, as pointed out by Holm, l. c., there is very good authority for maintaining the genus *Dentaria* as distinct from *Cardamine,* and very few authors, indeed, have followed Schulz. Furthermore, as pointed out by the writer, l. c., Schulz appears to have misunderstood *C. digitata* Richards., and the plant which he discussed under *C. hyperborea* appears largely to have been *C. Blaisdellii* Eastw. of the Bering Sea region. Certainly the plant he described is not Richardson's plant at all.

Cardamine digitata Richards. still remains a very rare plant in most herbaria, and, as far as the writer is aware, it has never been illustrated. It is a plant of not-too-wet tundra, reaching south to the tree line, but apparently not truly arctic, since at Cape Dalhousie, in latitude 70° N., specimens were in beginning anthesis in the early half of August (*2766*). *Cardamine digitata* prefers rather dry, peaty soil and often grows on the sides of large "niggerheads." The slender rhizomes and the vegetative reproduction have been well described by Holm, l. c.; the rhizomes are deeply buried in the turf and can be dug out only with the greatest care. Fructification is poor, and as a rule but half of the ovaries are fertile. Mature siliques are 30 to 40 mm. long and 2 mm. wide, gradually tapering into a slender style 2 to 3 mm. long and containing from 5 to 8 seeds. The seeds are oval, somewhat flattened, 1.4 mm. long and 0.8 to 1 mm. wide, greyish-brown, smooth.

Richardson, l. c., is mistaken when he says of the color of the flowers: "alba vel purpureo tincta." The petals invariably are milky-white. Ostenfeld, l. c., has pointed out also that Richardson's description of the leaves, "folia digitatim pinnata," is incorrect and that the leaves actually are pinnate.

Cardamine digitata appears to be an endemic of North America, rare in northwestern Alaska, fairly common along the arctic coast of the Yukon and Mackenzie Districts east to Hudson Bay, north to Banks and Victoria Islands, and south to the tree line.

Alaska: Teller, *Walpole 1465, 1561, 1810, 1890* (US); Mendelhall, Dall R. trail, Dall Cy. (US); Arctic Coast of Yukon Territory: *7182;* Herschel Isl., *Can. Arct. Exp. 248;* Northwestern Yukon: 66° 02′ N., 141° W., *D. D. Cairnes 83045* (Can); Richardson Mts.: *6678;* Mackenzie Delta and Arctic Coast: numerous collections; Great Bear Lake: Dease Arm, *4736;* Cape McDonnel, *5146;* Keewatin Distr.: Kazan R., *5812;* Baker Lake, *6123;* Mistake Bay, *5672.*

Draba ? aurea M. Vahl.

Mackenzie River Delta: Campbell Lake, dry hillsides on limestone, *1995;* East Branch, sandy river banks, *6996.*

These two plants, except for the entirely white petals, are a perfect match for *D. aureiformis* Rydberg, considered by Fernald (in Rhodora 36: 300. 1934) inseparable from *D. aurea* M. Vahl. By Mrs. E. Ekman both (in herb.) were named *D. Thomasii* Koch (*D. lanceolata* Royle), which most certainly they are not. The writer is very familiar with *D. aurea* in Greenland and in the East,

and it may be significant that in life this species did not suggest itself to him. Our specimens are biennial or at least appear to be hapaxanthic. The flowering stems are branching and the flowers white, the young siliques stellate-pubescent and the styles 1 mm. long and slender.

Draba crassifolia Grah.

MACKENZIE RIVER DELTA: North end of Richards Isl., *2238;* KEEWATIN DISTR.: Kazan River, 63° N., *6037.*

New to the flora of the Northwest Territories.

Draba incerta Payson.

Draba ? glacialis β Hook. Fl. Bor.-Am. **1**: 51. 1830.

GREAT BEAR LAKE: *J. M. Bell 22874* (Can).

In the Gray Herbarium is a Franklin Expedition plant labelled: "C[d]. H[s]. [Cumberland House] to Bear L.—R[ichardson]. June–Aug. Draba glacialis *β*." It is in anthesis, without fruit, but seems typical *D. incerta.* New to the flora of the Northwest Territories.

Draba luteola Greene.

GREAT BEAR LAKE: Keith Arm, *3460, 3462;* north shore, *4739, 4946, 5004;* McTavish Arm, *5272;* Leith Pt., south shore, *3580;* CORONATION GULF: *Can. Arct. Exp. 426* (unnamed); BRITISH COLUMBIA: Mt. Selwyn, 56° 01′ N., *H. M. Raup & E. C. Abbe 3915, 4104* (distr. as *D. borealis* DC.).

The material listed above is a good match for *D. luteola* Greene, otherwise known from Colorado and Utah. It is the plant which the late Mrs. E. Ekman (Sv. Bot. Tidskr. **28**: 80. 1934) called a hybrid: *D. aurea* × *daurica* and "probably also *Dr. arabisans* Michx." (Fernald, l. c., p. 251).

Our plant grew on sandy, calcareous beaches. In life the petals were white or creamy white, not yellow. In most of our material the lower part of the stem and basal leaves are tinged with purple.

Draba oligosperma Hook. Fl. Bor.-Am. **1**: 51. 1829.

GREAT BEAR LAKE: Etacho Pt., 1500′ elev., *3498;* McTavish Arm, east shore, greenstone hills, 900′ elev., *5302.*

Characteristic for this species is the very remarkable elongation of the inflorescence, which, as pointed out by Hooker, l. c., takes place as early as anthesis. So far as the writer is aware, this is not paralleled in any other of the dwarf arctic or boreal Drabas. Schulz incorrectly places *D. oligosperma* in the section *"Chrysodraba,"* describing the petals as being yellow ("flava"); Hooker correctly states that they are white ("petala alba"), but in drying they may turn a pale yellow. Part of Hooker's type, "Summit of limestone hill, Mack. R. 68° *Dr. Rich.,"* is in the Gray Herbarium. It is a somewhat more slender plant than the writer's.

Draba Palanderiana Kjellm. in Vega Exp. Vet. Iakt. **2**: 45. 1883.

RICHARDSON MTS.: West of Mackenzie Delta, gravelly slopes, 4000′ elev., *6595, 6671, 6673, 6675.*

This curious *Draba,* which is a close match for Kjellman's plant from Seward Pen., Alaska, was interpreted by the late Mrs. Ekman as *D. nivalis* × *pilosa.* It forms large, loose rosettes. The inflorescence is capitate in anthesis; the flowers large, white, but turning yellow in drying. The siliques are lanceolate, glabrous, with a long style. A specimen from the type locality, Teller [Port Clarence], Alaska, *Walpole 1402* (US), is 20 cm. in diam. with several hundred flowering scapes.

Draba praealta Greene, Pitt. **3**: 306. 1898.

GREAT BEAR LAKE: Smith Arm, *5003, 5005, 5006.*

New to the flora of the Northwest Territories.

Smelowskia calycina (Steph.) C. A. Mey.

RICHARDSON MTS.: West of Mackenzie Delta, barren alpine ridges, between 2000 and 3000′ elev., *6596, 6680, 6821.*

Although the plants flower profusely, the fruiting is very poor, and but a single silique, containing one good seed, could be found. Not previously recorded from the Northwest Territories.

Arabis Drummondi Gray.

RICHARDSON MTS.: West of Mackenzie Delta, *6819;* GREAT BEAR LAKE: Etacho Pt., 1500′ elev., *3494.*

New to the flora of the Northwest Territories.

Arabis Holboellii Hornem. See Rollins in Rhodora **43**: 440. 1941.

GREAT BEAR LAKE: Bear River, *3364;* Smith Arm, *5080;* McTavish Arm, east shore, *3705;* north shore, *5304.*

Our specimens are perennial and a perfect match for the plant in its type locality (Godhavn, Greenland), and they represent var. *typica* Rollins, recorded by him, l. c., in the far northwest, from Yukon and Alaska. New to the flora of the Northwest Territories.

Arabis Hookeri Lange.

MACKENZIE RIVER DELTA: Campbell Lake, *1920, 1921, 1994;* East Branch, *6892, 7395;* Richards Isl., *2089;* Kittigazuit, *2362;* ARCTIC COAST: Atkinson Pt., *2623;* GREAT BEAR LAKE: McTavish Arm, north shore, *5202;* east shore, *5305A.*

Our specimens are very much like the plant of Greenland and are all biennial. *Arabis Hookeri* flowers very early and our nos. *1920, 1921,* and *1994,* collected June 15–17, 1927, have almost mature siliques. As in Greenland, *A. Hookeri* is a pronounced calciphile and a dung-lover. In the Mackenzie District it is often found below bird cliffs and around the burrows of ground squirrels. The seeds are strongly mucilaginous when wet. The cotyledons are incumbent.

Arabis Hookeri is a rare plant in most American herbaria, and, since originally collected by Richardson on the "Shores of the Arctic Sea, between long. 107° and 130°," it has been collected and recorded but a few times from North America (Yukon) outside of Greenland. There can be little doubt, however, that another plant, *Halimolobos virgatus* (variously known under *Sisymbrium, Stenophragma, Pilosella, Arabidopsis*), is identical with it. The arctic plant also has been transferred to *Halimolobos* as *H. Hookeri* (Lange) Schulz. Rollins, l. c., who points out that the reason for this is chiefly the incumbent cotyledons, brings it back to the original specific name as *Halimolobos mollis* (Hook.) Rollins. While the transfer to *Halimolobos* may be justified, it is, nevertheless, interesting to note that another recent monographer of the genus points out that in *Arabis* the "cotyledons vary from accumbent to incumbent or they may be quite oblique" or even "accumbent and incumbent on the same plant" (Hopkins in Rhodora **39**: 72. 1937). Be this as it may, *Halimolobos virgatus,* with its host of "aliases," should be added to the synonyms of *A. Hookeri.*

Arabis lyrata L., Raup in Jour. Arn. Arb. **17**: 259. 1936.

GREAT BEAR LAKE: McTavish Arm, *3607, 3646, 3657, 3732, 5273.*

Raup, l. c., suggests that *Sisymbrium arabidoides* Hook., Fl. Bor.-Am. **1**: 63. 1830, "to Lat. 68°," is our plant. But Hooker, l. c., stresses the fact that his

plant is annual and has incumbent cotyledons. Our plant is glabrous throughout, is distinctly perennial, and has accumbent cotyledons.

Braya

Ostenfeld very properly stated that "there is much confusion concerning the arctic species of *Braya*" (Gjöa Exp. 17. 1909). One reason why this is so is that even in the Arctic these plants are rare and of a most peculiar and spotty distribution, suggesting special soil requirements. They are therefore not at all well represented in most herbaria. Four species were collected by members of the Franklin Expeditions and three were first described from our region.

Braya purpurascens (R. Br.) Bunge is perhaps the best-known and most widely distributed. Study of this species in cultivation is probably necessary in order to understand its relation to related species such as *B. Longii* Fern., *B. americana* (Hook.) Fern., and the very near *B. Thorild-Wulffii* Ostenf., as well as *B. purpurascens* var. *dubia*.

Braya glabella Richards. has been the cause of most of the misunderstanding and it has been interpreted in different ways by almost every writer who has dealt with it. Gelert (Bot. Tidsskr. **21**: 292. 1898), who examined the type in the British Museum, was the first to point out that, contrary to the opinion of most previous writers, *B. glabella* was quite distinct from *B. purpurascens*. He claimed also that it was inseparable from *B. alpina* Sternb. & Hoppe of Central Europe, Greenland, and northern Scandinavia.

Rouy (Ill. Pl. Eur. Rar. fasc. 11. 84, *tab. 254*. 1899), who apparently had not seen Richardson's type of *B. glabella*, considered it more closely related to *B. purpurascens* and quite distinct from the plant of Greenland and Scandinavia, for which he proposed the new name *B. linearis* Rouy. Ostenfeld, l. c., agreed with Rouy that the plant of Greenland and Scandinavia was distinct from *B. alpina* of Central Europe but thought that Gelert was correct when stating that the plant of Greenland and Scandinavia was inseparable from that of arctic America. Ostenfeld, therefore, correctly concluded that Rouy's name was superfluous and that Richardson's *B. glabella* must stand. Alm (in Acta Fl. Suec. **1**: 250–252. 1921), who again revised the group, came to the same conclusion. Schulz (in Pflanzenr. 86 (IV. **105**): 230. 1924), on the other hand, agreed with Rouy, saying about *B. glabella:* "haec species a *B. alpina* et *B. lineari* habitu robustiore et siliquis crassioribus distinguitur," thereby showing that he, after all, was perhaps not referring to Richardson's plant but to *B. pilosa* Hook., although he later reduced the latter to a "forma" of *B. purpurascens*.

Braya pilosa Hook. has been largely ignored and the writer was particularly pleased to secure abundant material in the fruiting stage from the type locality of what he considers must be *B. pilosa*.

Braya glabella Richards. in Franklin's Journ. App. 743. 1823; Hook. Fl. Bor.-Am. **1**: 65. 1830; Ostenf. in Gjöa Exp. 17. 1909; Alm in Acta Fl. Suec. **1**: 247–262, *tab. 16, figs. 4–7*. 1921.

Braya alpina Gelert, Bot. Tidsskr. **21**: 291, *fig. 2*. 1898, not Sternb. & Hoppe.

Braya linearis Rouy, Ill. Pl. Eur. Rar. fasc. 11. 84, *tab. 254*. 1899.

To Richardson's description it may be added that the whole plant is often tinged with purple. The stem, pedicels, and petioles (the blades only when young) are sparsely clothed with short, white, adpressed simple or bifurcated trichomes. In anthesis the inflorescence is capitate and barely exceeds the leaves; later a very considerable elongation takes place and fruiting specimens

are 15 to 20 cm. high. The mature siliques are 1 to 1.2 cm. long, on very short pedicels, almost terete, about 1.5 mm. in diameter. The style is short and conical in distinct continuation of the silique. The valves are glabrous and tinged with purple. Each cell contains from 10 to 14 dark brown seeds in two distinct rows. The seeds are oblong, pointed, about 1 mm. long, finely pebbled. The root is a weak tap-root, lasting only a few years.

Braya glabella flowers very early and specimens with mature fruits were collected on June 23–26, 1928. We saw this species but once, not far from the type locality (Copper Mts., north of Dismal Lakes).

Great Bear Lake: North shore of Dease Arm, *4698* (fruiting specimens), *4699* (flowering specimens from edge of snow bank).

General Distribution: Great Bear Lake, W. & E. Greenland and N. Scandinavia.

Braya humilis (C. A. Mey.) Robins. Syn. Fl. N. Am. **1:** 141. 1895.

Sisymbrium humile C. A. Mey. in Ledeb. Fl. Alt. **3:** 137. 1831, but first published in Hook. Fl. Bor.-Am. **1:** 62. 1830, credited to "Ledebour, MSS. ined."

Sisymbrium arabidoides Hook. Fl. Bor.-Am. **1:** 63, *tab. 21.* 1830, at least in part.

Pilosella Richardsonii Rydb. in Torreya **7:** 159. 1907.

Braya Richardsonii (Rydb.) Fern. in Rhodora **20:** 203. 1918.

Braya alpina sensu Macoun & Holm, Rept. Can. Arct. Exp. **5A:** 13. 1921, non Sternb. & Hoppe.

Braya glabella sensu Holm, Rept. Can. Arct. Exp. **5B:** 35. 1922, non Richards.

Meyer, l. c., states that the plant is biennial, while Hooker, l. c., says it is perennial. The latter view is correct with regard to our plant, but the root is weak and the plant usually dies after the second flowering.

Braya humilis is a variable species. On limestone cliffs along the Mackenzie there grows a gray-canescent, lilac-flowered plant which is Rydberg's *Pilosella Richardsonii* (in his Rocky Mt. Flora, p. 341, placed under *Arabidopsis* with the synonym *Sisymbrium humile* Hook., non Meyer). On the Arctic Coast the plant looks somewhat different and has slightly smaller and pure white flowers. This I suspect is at least in part what Hooker, l. c., called *Sisymbrium arabidoides* and which he illustrated in *tab. 21.*

Mackenzie River Delta: Campbell Lake, *1991;* Arctic Coast: North end of Richards Isl., *2228, 2234, 2235;* Atkinson Pt., *2622;* Cape Dalhousie, *2761;* Liverpool Bay, *2890;* Victoria Isl.: *Can. Arct. Exp. 411* (distr. as *B. alpina*); Great Bear Lake: North shore, Haldane R., *5039;* McTavish Arm, north shore, *5177;* Bear River, Mt. Charles, *3294, 3331;* Mackenzie River: Bear Rock, near Ft. Norman, 1300′ elev., *3383.*

General Distribution: Circumpolar, arctic-boreal. Alaska, Yukon, Mackenzie south to Alberta, James Bay and southern Hudson Bay, Gulf of St. Lawrence, Newfoundland, E. & W. Greenland. Not in Iceland.

Braya pilosa Hook. Fl. Bor.-Am. **1:** 65, *tab. 17A.* 1830.

Braya purpurascens f. *pilosa* Schulz in Pflanzenreich 86(IV. **105**): 235. 1924.

There are in the National Herbarium of Canada two sheets of what is undoubtedly part of the type collection of *Braya pilosa* Hook. Both have labels written by J. M. Macoun. The first, *2179* (Can), reads: "Braya pilosa Hook. Sea shores, mouth of Mackenzie River, Lat. 70°, N. W. T. Richardson." It consists of a branching caudex bearing a flowering scape from each fork. The flowers are very large, with petals 7 mm. long. The other sheet, *2178* (Can), is labelled: "Braya alpina Sternb. & Hoppe var. glabella Wat. Sea shores between Mackenzie and Coppermine Rivers, N. W. T. Dr. Richardson." A second label is marked: "Ex. Herb. Musei Brittanica. Mouth of River Mackenzie Arctic North Coast. Dr. Richardson." The second plant shows a strong

tap-root branching into 11 caudices each bearing a flowering scape from 6 to 8 cm. high. The flowers are slightly smaller than in *2179* and the whole plant is more hirsute. It is a perfect match for Hooker's *plate 17A* and for his description of *B. pilosa.*

Fruiting specimens of what is undoubtedly *B. pilosa* were collected on the Arctic Coast east of the Mackenzie Delta, in the latitude of the type locality (latitude 70°) : North end of Richards Isl., *2229;* Atkinson Pt., *2621;* Cape Dalhousie, *2760;* Liverpool Bay, *2889.*

Our plant was at first taken to be *B. glabella,* but when later this plant was collected near its type locality the difference at once became apparent. The leaves, scapes, pedicels, and the valves of the mature silique in our plant are sparsely clothed with a short, soft pubescence of simple and bifurcated gray hairs. The whole plant is green and but very rarely tinged with purple. The inflorescence is elongated in fruit but less so than in *B. glabella.* Also the mature siliques are broader than in that species, distinctly broader below the middle and decidedly flattened, with a filiform style 1.2 to 1.5 mm. long. The seeds are similar to those of *B. glabella* but decidedly paler, 10 to 14 to each cell. Richardson observed that the flowers are very fragrant, comparing the "smell of the blossoms to that of Lilac."

Braya pilosa apparently flowers very early, and, although the writer diligently searched for them during several seasons spent near the Mackenzie Delta, he never succeeded in finding flowering specimens, the reason being that the Arctic Coast, where the plant grows, is almost inaccessible during the early part of the season due to ice conditions. Franklin's party reached the sea-coast on July 8, 1826, which must have been in an early season, for Richardson was able to proceed east along the coast unhindered by ice.

In 1928 the late Dr. M. O. Malte collected in the Hudson Strait region a *Braya* which he tentatively named *B. glabella* Richards. The Hudson Bay plant is definitely not *B. glabella* Richards. but is a close match for our material of *B. pilosa.* As in the west, it flowers very early and only fruiting specimens have been collected. Of the Hudson Bay plant the writer has seen the following collections: Northern Quebec: Wakeham Bay, *M. O. Malte 120191* (Can, G); Southampton Isl.: *M. O. Malte 120677* (Can, G).

On Baffin Island Malte collected another *Braya* which he called *B. purpurascens* Bunge (Lake Harbour, *M. O. Malte 120294,* Can, G). This differs from the Wakeham Bay and Southampton Island plants by the less elongated fruiting head, shorter and stouter styles, and by the shorter and more plump siliques. Polunin, l. c., also collected the latter plant at Lake Harbour (*1121,* Can), labelling it a variety of *B. purpurascens* (R. Br.) Bunge.

The writer has seen specimens of *B. purpurascens* from Greenland that are a close match for the Baffin Island plant (W. Greenland, Ingnerit Fj., 71° 7′ N., *M. P. & R. T. Porsild,* Can).

Braya pilosa Hook. no doubt is more closely related to *B. purpurascens* than to *B. glabella,* but, because of its early seasonal appearance and very large and fragrant flowers, much elongated fruiting racemes, long and slender styles, and erect habit of growth, it is considered abundantly distinct.

Braya purpurascens (R. Br.) Bunge in Ledeb. Fl. Ross. **1**: 195. 1841.

Platypetalum purpurascens R. Br. in Parry's 1st Voy. App. 267. 1823.

Platypetalum dubium R. Br. ibid.

Braya Thorild-Wulffii Ostenf. in Medd. om Grønl. **64**: 176. 1923.

? Braya americana (Hook.) Fern. in Rhodora **28**: 203. 1926.
? Braya Longii Fern. ibid., 202. 1926.

Braya purpurascens is a variable species which apparently is circumpolar. Where growing together with *B. pilosa* and *B. glabella,* it flowers at least three weeks later. The scapes are shorter and ascending, in fruit seldom more than 10 cm. high; the fruiting raceme is capitate or at least not much elongated. The mature siliques are plump, rarely 10 mm. long, and from 1.2 to 2 mm. thick. The style is short and thick, about 0.5 mm. long. The seeds apparently are sticky when wet but are not conspicuously mucilaginous.

In North America *B. purpurascens* is distributed from the shores of Bering Sea along the Arctic Coast to eastern Greenland, north to the end of land and south to lat. 60° in Labrador (? Newfoundland) and to high mountains of Alberta. Apparently it is a decided calciphile.

DROSERACEAE

Drosera anglica Huds.

Great Bear Lake: McTavish Arm, north shore, in a marl bog, *5237.*

New to the flora of the Northwest Territories.

SAXIFRAGACEAE

Saxifraga bronchialis L. ssp. **Funstonii** (Small) Hultén.

Richardson Mts.: West of Mackenzie Delta, *6684, 6829, 6830.*

New to the flora of the Northwest Territories.

Saxifraga ferruginea Grah.

Mackenzie River Delta: Peel River, 1888, *McConnel 8417* (Can), distributed as *S. stellaris* L.

New to the flora of the Northwest Territories.

Saxifraga flagellaris Willd.

Richardson Mts.: West of Mackenzie Delta, *6683, 6828.*

New to the flora of the Mackenzie District.

Saxifraga foliolosa R. Br.

Arctic Coast: Atkinson Pt., *2629.*

New to the flora of the Mackenzie District.

Saxifraga nivalis L.

Great Bear Lake: Dease Arm, *4842;* McTavish Arm, *3783, 5204, 5307.*

The above numbers represent a new western limit in the Northwest Territories, since previous records should be referred to *S. reflexa* Hook.

Saxifraga reflexa Hook.

The writer, in Rhodora **41**: 242. 1939, has pointed out that the plant which in Alaska has passed for *S. nivalis* really belongs here (see notes on that species). In the Mackenzie Delta and on the Arctic Coast, *S. reflexa* is common east to Cape Dalhousie but apparently is not found far inland.

Parnassia parviflora DC.

Great Bear Lake: McTavish Arm, east shore, *3749.*

New to the flora of the Northwest Territories and not previously collected in the Mackenzie basin outside the Rocky Mountains.

Ribes hudsonianum Richards.

Mackenzie River Delta: Aklavik, *7309.*

Common at Great Bear Lake and in rich woods north to some distance south of the tree limit.

Ribes lacustre (Pers.) Poir.

MACKENZIE DISTR.: Yellowknife R., Gordon Lake, *J. Carroll 67A* (Can).

Ribes lacustre of Hook. Fl. Bor.-Am. **1**: 232. 1834, "To Fort Franklin and Bear Lake, near the Arctic Circle," is *R. oxyacanthoides* L., and the above is the first record of true *R. lacustre* from the Northwest Territories.

ROSACEAE

Spiraea Beauverdiana Schneid. See Rhodora **41**: 244. 1939.

This western species is very common in the higher parts of the Mackenzie Delta in heath and open birch woods, and near the East Branch it reaches the Arctic Coast. It extends but a short distance eastward, to the Eskimo Lake Basin, 2nd lake, *2991*.

Luetkea pectinata (Pursh) Kuntze.

In the National Herbarium of Canada is a specimen labelled: N. W. T., Peel R., Mackenzie, 1889, *McConnel 5722*. McConnel crossed from the Mackenzie Delta into Yukon and Alaska via the Rat-Porcupine R. Pass, and this alpine species was no doubt collected in the mountains west of the Delta.

Amelanchier sanguinea (Pursh) DC.

GREAT BEAR LAKE: Bear River, lower slopes of Mt. Charles, *3298*.

Following Wiegand, in Rhodora **14**: 138. 1912, the above specimens are best placed here. This is the "saskatoon berry" of the Mackenzie, common at least to the Good Hope Ramparts.

Rubus pubescens Raf.

MACKENZIE RIVER DELTA: East Branch, *6550*.

Previously known in the Mackenzie basin north to Simpson.

Potentilla ? pectinata Raf.

ARCTIC COAST: Atkinson Pt., *2635*.

This plant has 3- to 5-parted basal leaves, almost circular in outline, with much broader lobes than in typical *P. pectinata*. The leaves are thinly tomentose-pruinose beneath but not silky-villose. It may be *P. glabrella* Rydb., a species not too well-marked from *P. pectinata*, but differs from it by the almost orbicular leaves and the large flowers, which have broad, deeply notched petals.

Potentilla pensylvanica L.

RICHARDSON MTS.: West of Mackenzie Delta, *6603, 6638, 6834;* ESKIMO LAKE BASIN: *3036*.

Previously known northward to Great Bear Lake.

Potentilla pulchella R. Br. var. **gracilicaulis** var. nov.

Caules floriferi 5–30 cm. alti, 3–8-flori, e basi ascendente erecti, folia 1 vel raro 2 in parte inferiore ferentes, tenuissimi, rubiginosi, sericeo-villosi mox glabrescentes; folia basalia longipetiolata, sub-bijugata, foliola terminalia longe petiolata, superne glabrata, subtus sparse sericeo-villosa; stipulae castaneae, glabrae. Flores parvi sunt, illosque speciei in mentem vocant.

ARCTIC COAST: Atkinson Pt., 70° N., 131° 20′ W., top of sandy cutbank, Aug. 1–3, 1927, *A. E. & R. T. Porsild 3632* (TYPE); same place, *2633;* Tuktuayaktoq, *7425;* Cape Dalhousie, *2776–2778;* Cape Bathurst, *Can. Arct. Exp. 511;* YUKON TERRITORY: Herschel Isl., *Can. Arct. Exp. 241, 241A*.

Our plant is a characteristic species in sandy places along the arctic coast east of the Mackenzie. It is abundantly distinct from the typical form except in the floral parts. It may be *P. pulchella β elatior* Lange, Consp. Fl. Groenl. 4. 1880, which is *P. subarctica* Rydb., in N. Am. Flora **22**: 347. 1908, but if so it is very different from a plant from Hudson Bay which Rydberg, in the National Herbarium of Canada, has named *P. subarctica*. Polunin, l. c., has taken up var. *elatior* Lange for this, suggesting that it is a "luxuriant southern form." Of *β elatior* Lange, Th. Wolf (in Bibl. Bot. **16**[Heft 71]: 152. 1908) merely says: ". . . die ich mit Abromeit (Bibl. bot. Heft 42. 7.) nur als 'Standortsformen, die in einander übergehen,' auffasse. . . ."

Potentilla pulchella var. *gracilicaulis* is, perhaps, less "arctic" than the species. In the large series collected at Cape Dalhousie (*2766–2768*) some specimens are only a few centimeters high, but none of them are transitional to the species. On Aug. 7–14, 1927, the plant was still in anthesis; it probably does not mature fruits there except in favorable seasons.

Typical *P. pulchella* apparently is an eastern species which is rare or restricted to high latitudes west of Hudson Bay, and the plant which Hooker, l. c., reports from "Shores of the mainland between the Coppermine and Mackenzie Rivers. *Dr. Richardson*" is undoubtedly our plant.

Potentilla rubricaulis Lehm. Nov. Stirp. Pug. **2**: 11. 1830, et Rev. Pot. 68, *tab. 30.* 1856.

Arctic Coast: Cape Dalhousie, 70° 20′ N., 129° 55′ W., dry sandy plain, Aug. 7–14, 1927, *2774, 2774A;* Liverpool Bay, *2905.*

This is one of the rarest of the arctic *Potentillae* and one which, as pointed out by Simmons (Fl. Ellesmere Land, 50–54. 1906), has been generally misunderstood by Rydberg and others. Because the type came from Bear Lake ("About Bear Lake, in lat. 66°. *Dr. Richardson*"), the writer was particularly anxious to obtain authentic material. In this he failed in the Bear Lake Region, but on the Arctic Coast, at Cape Dalhousie, he obtained a large series of specimens that perfectly match Lehmann's description and beautiful plate.

Our specimens had immature fruits in the middle of August and also fully expanded flowers on the same plants. The flowers are almost 2 cm. in diameter, somewhat larger than in the type (Th. Wolf, l. c., 170). Lehmann and Wolf have both remarked that *P. rubricaulis* bears some resemblance to 5-nate forms of *P. nivea,* but Wolf, l. c., correctly states that it may at once be distinguished from *P. nivea* and forms by its conical style; it should be noted, however, that in the Mackenzie District the base of the style, in all forms of *P. nivea* examined by the writer, is enlarged and papillose, although the style itself is slender and filiform as described by Wolf.

The tomentum of the undersides of the leaves, in our plant as well as in all other material of *P. rubricaulis* seen by the writer, is thinner than in most forms of *P. nivea,* so that the main nerves are distinctly visible. Also characteristic of *P. rubricaulis* is the fact that the tomentum extends in a small, white tuft, from each tooth or lobe of the leaflets.

Distribution: *Potentilla rubricaulis* extends from Great Bear Lake and the Arctic Coast across the Arctic Archipelago east to N. W. Greenland and to the Franz Joseph Fiord region of the east coast.

Sibbaldia procumbens L.

Richardson Mts.: West of Mackenzie Delta, common locally in herb mats, 1500′ elev., *6833;* Great Bear Lake: Etacho Pt., 1500′ elev., *3502;* Keewatin Distr.: Kazan R., *5827, 6045;* Lake on Tha-anne R., *5589.*

The North American distribution of *Sibbaldia* is rather peculiar and very disrupted. It is common in E. & W. Greenland, north to 73° and 72°, rare on the Labrador coast, isolated in mountains of Newfoundland, Gaspé, and New Hampshire, fairly common in the Hudson Bay region south to James Bay, north to southern Baffin Island, and west to Central Keewatin. It is common in the high mountains of Alberta and British Columbia, Montana, Idaho, Wyoming, Colorado, and Utah, south to California, with two isolated, alpine stations in the Mackenzie District and one in Central Alaska. It is also common on islands of the Bering Sea. The species was previousy unrecorded from the Mackenzie District.

Geum glaciale Adams.

Richardson Mts.: West of Mackenzie Delta, between 2000 and 4000′ elev., *6602, 6694.*

In Canada otherwise known only from Yukon Territory. New to the flora of the District of Mackenzie.

Dryas octopetala L.

Mackenzie River Delta: E. Branch, *7032;* Campbell Lake, *1999;* Richards Isl., *2098.*

A western species common in the mountains of Alaska and Yukon east to the Mackenzie Delta. East of the Delta it has been collected but a few times.

LEGUMINOSAE

Astragalus Collieri (Rydb.) comb. nov.

Atelophragma Collieri Rydb. in Bull. Torr. Bot. Cl. **55**: 127. 1928.

Great Bear Lake: East shore of McTavish Arm, open spruce woods on sandy soil, *3751.*

Our specimens are with mature fruits; they match the description as well as the type, which came from Eagle, Alaska, June 29, 1902, *A. C. Collier, 50* (US *no. 379736*), and also: Near Post on Forty Mile Creek, Yukon Valley, June 9, 1893, *F. Funston 67,* teste Rydb. (G), except that the pods in ours (collected late in the season) are merely puberulent.

Astragalus Collieri superficially resembles *A. frigidus* var. *americanus* (Hook.) S. Wats., from which it may at once be distinguished by its dark purplish stems and peduncles, which are covered with a minute white pubescence, and by its purplish brown pods. These are 2 cm. long, turgid, with a very narrow stipe 0.5 to 0.6 cm. long, and contain from 5 to 8 seeds. The seeds are dark olive green, dull, orbicular, about 2 mm. in diameter.

The known distribution is: Eastern central Alaska, south to Glacier Bay, east to Great Bear Lake. New to the flora of Canada.

Astragalus linearis (Rydb.) A. E. Porsild. See Rhodora **41**: 250. 1939.

Richardson Mts.: West of Mackenzie Delta, windswept gravelly ridges, 3000′ elev., July 7–10, 1933, *6697* (flowering specimens); Coppermine River: Fort Hearne to Bloody Falls, 1931, *A. M. Berry 14* (fruiting specimens); Yukon Territory: Dry Gulch, *Gorman 1014;* White Horse, *Eastwood 625* [both in Can. Nat. Herb., teste Rydberg].

The above numbers appear to be the first collections from the Northwest Territories, since a fragment in the National Herbarium of Canada from Great Bear Lake, collected by *J. M. Bell* (*22899*, Can) and named *Atelophragma lineare* by Rydberg, is really *Astragalus eucosmus* Robins. Although Rydberg, in N. Am. Flora **24**: 368. 1929, recorded *A. lineare* only from "Mackenzie and Yukon Territories," there is in the National Herbarium of Canada a typical specimen from Manitoba: Mouth of Qu'Appelle River, June 28, 1906, *John Macoun & William Herriot 70479,* labelled by Rydberg himself *Atelophragma lineare.* The

known distribution of *Astragalus lincaris* is: Alaska, Yukon, Northwest Territories east to Coppermine River and south to Manitoba.

Astragalus yukonis M. E. Jones, Rev. Astr. 83, *tab. 7, fig. 28.* 1923.

Mackenzie River Delta: South end of Richards Isl., on sandy riverbanks, where it formed large clumps, *2105.*

New to the flora of the Northwest Territories.

Oxytropis arctica R. Br. in Suppl. App. Parry's 1st Voy. 278. 1824; Hook. Fl. Bor.-Am. **1:** 146. 1834 (var. *subumbellata* and var. *microphylla*); Gray in Proc. Am. Acad. **20:** 4. 1884, in part; Simmons, Phytogeogr. Arct. Am. Arch. 112. 1913; Fern. in Rhodora **30:** 144, *tab. 172* (upper). 1928.

Oxytropis Roaldi sensu Macoun & Holm in Rept. Can. Arct. Exp. **5A:** 17, *tab. 8, fig. 2.* 1921, ? non Ostenfeld.

Oxytropis coronaminis Fern. in Rhodora **30:** 151, *tab. 175.* 1928.

Of the numerous critical species of plants in the flora of boreal and arctic North America, most of the members of the genus *Oxytropis,* as shown by Fernald's revision in Rhodora **30:** 137–155. 1928, have been much misunderstood by earlier writers. Hooker, l. c., clearly did not understand the genus, nor did John Macoun in his Catalogue of Canadian Plants, nor in more recent times J. M. Macoun and Theodore Holm. In addition to taxonomic difficulties, the genus offers a number of geographical puzzles, as pointed out by Simmons, l. c., 111.

In the course of many seasons' collecting in many parts of the Canadian Arctic, from the Alaska boundary to Hudson Bay, the writer paid special attention to this genus. Of its purple-flowered members, two of the most elusive and puzzling species appear to be *O. Roaldi* Ostenf. and *O. arctica* R. Br. In six seasons' collecting in the Mackenzie District the writer never succeeded in finding the former, which thus far is known only from the type locality (Herschel Island). Of the latter Fernald, l. c., in addition to the type (Melville Island), recognized but one collection (between Coppermine River and Cape Alexander, *Rae*); Ostenfeld, l. c., did not find it in the Gjöa Expedition collections. Several collections made by members of the Canadian Arctic Expedition, 1915–1918, and recorded by Macoun & Holm, l. c., as *O. Roaldi,* Fernald was unable to identify with either that species or with *O. arctica.* He therefore described the Can. Arct. Exp. plant as *O. coronaminis,* to be distinguished from *O. arctica* "by its much larger flowers, longer calyx-tube and -teeth and very large corolla with vexillum fully twice as broad as in true *O. arctica.*" But in several numbers cited by Fernald in the National Herbarium of Canada, the size of the flower and the length of the corolla, calyx-tube and -teeth vary greatly. In McMillan's collection from Melville Island (*77294,* Can), the corolla is 1.5 cm. long and the teeth of the calyx ¼ as long as the tube. In a specimen from near the type locality of *O. coronaminis* (*A. E. & R. T. Porsild 4745*), the flowers are even smaller and the calyx-teeth vary in length from ¼ to ⅓ of the length of the calyx-tube. Likewise in the stipules, often of systematic value in this genus, there does not appear to be any difference between *O. coronaminis* and *O. arctica.* To the description given by Fernald, l. c., for *O. coronaminis,* it may be added that the veins of the free blades of the stipules are green and very conspicuous; the main vein has a number of upward pointed side branches and ends in the green tip of the blade; the edges, besides the long, white ciliae, are beset with large, sessile glands or papillae.

Thus if *O. coronaminis* is conspecific with *O. arctica,* the distribution of the latter becomes more natural, making it an endemic of the central and western Arctic Archipelago and the mainland from Anderson River east to Bathurst Inlet, possibly with an isolated station in mountains of east central Alaska (Steese Highway, Eagle Summit, 3880′ elev., *E. Scamman 806;* Richardson Highway, Miller House, 4810′ elev., *idem 807;* both in Gray Herb.). The following specimens are in the writer's collection from the Mackenzie District:

Arctic Coast: Cape Dalhousie, old dunes and dry tundra, *2780,* dry sandy slope, *2779B;* Great Bear Lake: North shore of Dease Arm, near headwaters of Horton R., *4745.*

Oxytropis Belli (Britt.) Palibine. See Fernald in Rhodora **30:** 150. 1928.

To the description and discussion by Fernald, l. c., it may be added that *O. Belli* forms large cushions a foot or more in diameter. The central root in old specimens sends out numerous freely forking branches, but these do not produce adventitious roots. In life the calyx is dark red with almost black teeth; the corolla is pinkish violet with a pale spot on the front of the vexillum and 4 or 5 bluish lines on each side; the scapes are reddish brown. On the west coast of Hudson Bay, *O. Belli* flowers before all other species of *Oxytropis.* The flowers are faintly fragrant.

Oxytropis campestris (L.) DC. (sensu str.); Hook. Fl. Bor.-Am. **1:** 147. 1834, var. *melanocephala* (in part only).

Oxytropis glabrata Rydb. Fl. Prairies and Plains 485. 1932, non *O. glabrata* (Hook.) Nels. in Univ. Wyom. Publ. Bot. **1:** 117. 1926.

Acaulescent with a strong tap-root ending in a multicipital crown; stipules membranaceous, translucent, white, sparingy villous to glabrate, the free blades long-ciliate and with a few large papillae, subulate, prominently nerved; leaves 10–15 cm. long, leaflets opposite, lanceolate, acuminate, sparingly adpressed-sericeous, soon glabrate, with involute margins, dark green; scapes 15–20 cm. high, brownish green, sparingy silky villous, soon glabrate, erect or ascending; spike subcapitate, slightly elongated in fruit, 10–15-flowered, the bracts linear, ¾ as long as the calyx; calyx dark green with rather short grayish black hairs; calyx-lobes black-hirsute, subulate, ¼ as long as the tube; corolla about 1 cm. long, in life pale yellow or dirty white, somewhat darker when dry; legumes grayish green, long-beaked, incompletely 2-celled, sparingly covered with short black hairs; seeds oblique-heartshaped, 1.5–2 mm. in diameter, greenish gray.

In open, sandy, or gravelly places from northern Labrador west to Yukon, not north of the tree-line.

Hudson Bay: Churchill, 58° 47′ N., 94° 14′ W., gravelly plain, July 3, 1930, *5480;* same place, *J. M. Macoun 79102* (Can); same place, *G. Gardner 68* (Can); same place, *N. Polunin 1949* (Can), distr. as *O. monticola* Gray; Labrador: Komaktorvik Fj., 59° 17′ N., 63° 45′ W., *V. C. Wynne-Edwards 7120* (Can); Mackenzie River: Fort Good Hope, *Miss E. Taylor 5353* (Can), as *O. Lamberti* Pursh; Yukon: Carmacks, *A. Eastwood 572* (Can).

The above numbers are such a close match for *O. campestris* of northern Europe that, although a number of related American species from time to time have been recorded under this name, there does not appear any good reason why the latter, in a strict sense, should not be applied to this plant. *Oxytropis campestris,* like *O. Maydelliana,* thus becomes almost circumpolar. Our plant is closely related to *O. gracilis* (A. Nels.) Schum., from which, however, it may at once be distinguished by the dark pubescence of the calyx and legumes. From the only other white-stipuled, pale-flowered northern species, *O. hyperborea,* it is easily distinguished by the absence of verticillate leaflets, the very characteristic subulate free parts of the stipules, and by the less dense vestment of hairs.

When Rydberg examined most of the material in the National Herbarium of Canada, he annotated several sheets of *O. campestris* as "*O. glabrata* (Hook.) A. Nels." There can be little doubt that while Rydberg well understood the species, he misapplied Nelson's interpretations of *O. glabrata.* When that author made his transfer he obviously had in mind Hooker's *Oxytropis campestris* var. *glabrata* (foliolis glabriusculis subsucculentis), but what Hooker meant by this is not at all clear; it might have been the glabrate form of *O. Maydelliana,* although the "subsucculent leaflets" strongly suggests *O. hudsonica.* There can be no doubt, however, as to which plant Nelson actually thought of, because in his discussion, l. c., he adds: "Besides the characters given by Hooker, the following drawn from the sheet cited below (*M. W. Gorman, 1365,* Nogheling R., Alaska, July 21, 1902) may be added: Sparsely strigose hairy on leaves and scapes; the leaflets often nearly or even quite glabrous above; the branches of the caudex dark-brown from the numerous dead glabrous petioles." This clearly shows that Nelson's *O. glabrata* is *O. Maydelliana* Trautv. Rydberg, l. c., does not mention the colour of the stipules, but from his annotations on sheets of the pale-stipuled *O. campestris* it is obvious that by *O. glabrata* (Hook.) Nelson he did not mean *O. Maydelliana* Trautv., which, in the Ottawa collection, he annotated *O. melanocephala* (Hook.) Rydb.

General distribution: Arctic and subarctic alpine Europe; Siberia; subarctic North America (? not in Alaska); not in Iceland.

Oxytropis hudsonica (Greene) Fern. in Rhodora **30:** 142. 1928.

Richardson Mts.: West of Mackenzie Delta, 1500–2000′ elev., *6608, 6700, 6838;* Arctic Coast: Liverpool Bay, *2908;* Great Bear Lake: Ft. Franklin. Common in Keewatin District.

In life the scapes of *O. hudsonica* are erect, ascending or sometimes decumbent, and conspicuously angled. The entire plant is fresh green and very viscid to the touch; the leaflets are somewhat fleshy and, due to the strongly involute margins, somewhat boat-shaped, obscurely keeled. The flowers are reddish purple, becoming almost blue in fading, and very fragrant with a perfume reminiscent of roses. The mature seeds are coal-black, reniform, smooth, dull, 1.6–1.8 × 1.2–1.4 mm.

Oxytropis hyperborea sp. nov.

Oxytropis campestris var. *melanocephala* Hook. Fl. Bor.-Am. **1:** 147. 1834, in part.

Oxytropis campestris (L.) DC. var. *sordida* Willd. sensu Holm & Macoun in Rept. Can. Arct. Exp. **5A:** 16. 1924, in part.

Oxytropis ? *borealis* sensu Fern. in Rhodora **30:** 143. 1928, non DC. Prodr. **2:** 275. 1825.

Herba acaulescens radice crassa descendente; folia 3–12 cm. longa, stipulae membranaceae vel chartaceae pallidae vel albescentes, longe sericeo-villosae, persistentes, laminae parte libera longe ciliata, longe attenuata et haud subulata, prominenter nervosa; foliola lineari-lanceolata, 1 cm. longa, 0.3–0.4 cm. lata, subverticillata, 3- vel 4-juga, matura ob rhachem elongatum habitu interdum alternata vel opposita, utrinque cum rhachi sericeo-villosa, supra in speciminibus e locis udis interdum glabrata, tenella margine subrevoluta, adulta revoluta vel fere revoluta; scapi 5–20 cm. alti, longe sericeo-villosi, vulgo erecti sed in speciminibus e regionibus borealibus ultimis plus minusve prostrati; spica subcapitata, sublaxiflora, elongans, 6–10-flora, floribus infimis saepius sat discretis; bracteae lineares calycem aequantes; calyx albus, sericeo-villosus, indumento pilis nigris abbreviatis commixto, quapropter, pubescentia albicante aetate labefacta, calyx obscuriore colore evadens; calycis lobi triangulares, apice subulati quam tubo ⅔ breviores; corolla circa 1.5 cm. longa, in speciminibus vivis ochroleuca

vel sordide albida, exsiccans in vexillo interdum puncto nigricante (in plantis vivis nullo vel vix obvio) maculata; legumina 1–1.5 cm. longa, subinflata, longirostrata, imperfecte bilocularia, indumento denso sericeo-villoso, pilis nigris paucis brevibus intermixto demum evanido.

In sandy and gravelly places or in dry tundra, from mountains of eastern Alaska and Yukon east along the Arctic Coast to Coronation Gulf, south to Great Bear Lake.

Mackenzie River Delta: East Branch, lat. 68° 55′ N., dry sandy slopes, July 21, 1934, *A. E. Porsild 7033* (type). In addition to the type the following specimens, all in the National Herbarium of Canada, may be considered typical: Alaska: Near Head of Chitina R., dry hillsides, 2500′ alt., *H. M. Laing 134, 135;* Arctic Coast of Yukon Territory: 69° 12′ N., 138° to 138° 30′ W., *7151;* Mackenzie River Delta: South end of Richards Isl., dry slopes, *7072;* same vicinity, *2106;* north end of Richards Isl., *2253;* same vicinity, *7449;* Arctic Coast: 6 miles east of Kittigazuit, sand dunes, *2502;* Cape Dalhousie, old dunes and dry tundra, *2779;* Great Bear Lake: North shore of Dease Arm, dry tundra and sand dunes, *4705;* Cape McDonnel, low tundra and lake shore, *5155;* Etacho Pt., elev. 1500′, alpine tundra, *3503;* Leith Pt., open woods and sandy beaches, *3583;* McTavish Arm, Hunter Bay, shady ravines near cold spring, *5328;* Dolphin & Union Strait: Bernard Harbour, *Can. Arct. Exp. 332* (in part); Clifton Pt., *Can. Arct. Exp. 690, 691;* Victoria Isl., *Can. Arct. Exp. 386.*

Oxytropis hyperborea is well-marked from the other yellow-flowered northern species by its verticillate leaflets, and from *O. Maydelliana* also by its pale stipules (for contrast with *O. campestris* see treatment of this species). It belongs in the group of arctic plants which Hooker and most later authors have cited under *O. campestris, O. campestris* vars. *glabrata, sordida* and *melanocephala, O. leucantha,* and *O. monticola.* Fernald, l. c., 142–144, when he wrote about this group and showed that the castaneous- or fulvous-stipuled plant is really *O. Maydelliana,* perhaps was the first to point to the existence of still another clear-cut species which he tentatively identified with *O. borealis* DC., from extreme E. Siberia. Because de Candolle listed *O. borealis* under the heading "*floribus purpurascentibus aut albis" rather than under "**floribus ochroleucis," and in view of the following passages in his description: "foliolis . . . subtus glabris . . . scapis folii longitudine, floribus capitatis, bracteis calycis nigro-hispidissimi longitudine," it seems scarcely possible to identify our Canadian arctic plant with *O. borealis* DC. This view is strengthened by the fact that *O. hyperborea* does not seem to occur in N. W. Alaska, nor has the writer seen any other pale-stipuled, yellow-flowered *Oxytropis* from northern Alaska. The fact that Hooker (Fl. Bor.-Am. **1**: 145) cited specimens of *O. borealis* collected by Lay and Collie (Kotzebue Sd.) is no proof of its presence in Alaska. These specimens may well have been *O. Maydelliana,* because Hooker obviously did not understand the northern members of this genus well. It may be significant also that Hooker, l. c., when copying (otherwise verbatim) de Candolle's description, left out the last epithet: "Stipulae pallidae."

For his treatment of *Oxytropis* for "North American Flora," Rydberg examined all arctic material in the National Herbarium of Canada. The low, northern form of *O. hyperborea* as exemplified by *Can. Arct. Exp. 332* from Bernard Harbour, Aug. 15, *F. Johansen,* and *nos. 690* and *691* from Clifton Point, is annotated by Rydberg as "*Oxytropis Johansenii* Rydb." Unfortunately sheet no. *332,* marked "type" by Rydberg, contains three plants, two of which are *O. hyperborea,* while the third is typical *O. Maydelliana.* The isotype of *"O. Johansenii,"* in N. Y. Bot. Gard., is all *O. hyperborea.* Rydberg's *"O. Johansenii"* (not to be confused with *O. Johannensis* Fern.) was never published. *Oxytropis monticola* Gray and *O. alpicola* Rydb. both have pale stipules. The

first has purple flowers and the latter is said to have decumbent peduncles and an ochroleucous corolla with a purple spot on the keel.

Oxytropis pygmaea (Pall.) Fern.

Richardson Mts.: West of Mackenzie Delta, 2000–3500′ elev., *6699, 6841;* Mackenzie River Delta: East Branch, *7037.*

New to the flora of the Northwest Territories.

Oxytropis retrorsa Fern.

Eskimo Lake Basin: 1st lake, *6936;* Great Bear Lake: Bear River, *3365.*

New to the flora of the Northwest Territories.

Lathyrus ? palustris L.

A *Lathyrus,* probably of this species, was observed in winter along the dog trail above Arctic Red River on the lower Mackenzie.

CALLITRICHACEAE

Callitriche autumnalis L.

Mackenzie River Delta: East Branch, *6920, 7237;* Eskimo Lake Basin: *2995, 3063, 6934;* Great Bear Lake: Bear River, *3366;* Keith Arm, *3438;* McTavish Arm, *3697.*

Perhaps common or at least occasional north to the limit of trees.

Callitriche verna L. emend. Lönnroth.

Eskimo Lake Basin: Setidgi Lake, *3180;* Great Bear Lake: McTavish Arm, *3713, 3697;* Keith Arm, *5279;* Keewatin Distr.: Lake on Tha-anne R., *6179;* Lower Kazan R., *6058, 6059.*

Probably common throughout the Northwest Territories north to the limit of trees or slightly beyond.

VIOLACEAE

Viola labradorica Schrank.

Great Bear Lake: South shore, Leith Pt., *3546;* McTavish Arm, *3584.*

New to the flora of the Mackenzie District.

Viola Langsdorffii Fisch.

Richardson Mts.: West of Mackenzie Delta, *7342.*

New to the flora of the Northwest Territories.

Viola pallens (Banks) Brainerd.

Great Bear Lake: Etacho Pt., 1500′ elev., *3504;* Keewatin Distr.: Kazan R., *5831, 5832, 6056;* Lake on Tha-anne R., *5591.*

New to the flora of the Northwest Territories.

Viola renifolia Gray var. **Brainerdii** (Greene) Fern.

Great Bear Lake: McTavish Arm, *5312.*

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt.

Mackenzie River Delta: Campbell Lake, *1952, 2004;* Richards Isl., *2111;* Eskimo Lake Basin: *3043, 3160;* Great Bear Lake: Ft. Franklin, *3220;* Dease Arm, *4776, 4814.*

Common or occasional on calcareous soil north to the Mackenzie Delta but not observed east of the Palaeozoic formation. At its northern limit all the plants appeared to be male.

ONAGRACEAE

Epilobium arcticum Samuelss.

Richardson Mts.: West of Mackenzie Delta, *6704, 6842.*

Previously known in Canada only from the Eastern Arctic.

Epilobium davuricum Fisch.

Arctic Coast of Yukon Territory: King Pt., *7187;* Mackenzie River Delta: Campbell Lake, *1939;* Kittigazuit Isl., *2376, 2506;* Great Bear Lake: Keith Arm, Deerpass Bay, *3445;* Dease Arm, *4846;* Keewatin Distr.: Kazan R., *5833, 6054.*

New to the flora of the Mackenzie District.

Epilobium palustre L.

Common northward beyond the limit of trees, and represented by many numbers in the writer's collections from the Mackenzie Delta, the Arctic Coast, Great Bear Lake, and Central Keewatin. Previously recorded in the Mackenzie basin north to 64° (*Richardson*).

HIPPURIDACEAE

Hippuris tetraphylla L. f. See Rhodora **41**: 264. 1939.

Arctic Coast of Yukon Territory: Shingle Pt., *6907.*

New to the flora of Canada.

HALORRHAGACEAE

Myriophyllum alterniflorum DC.

Eskimo Lake Basin: North shore of 2nd lake, *2997;* Great Bear Lake: Etacho Pt., 1500′ elev., *3506;* Dease Arm, *4706.*

Our specimens are all sterile. New to the flora of the Northwest Territories.

Myriophyllum exalbescens Fern.

Mackenzie River Delta: Aklavik, *7308;* Campbell Lake, *2026;* East Branch, *6921, 7239, 7249;* Eskimo Lake Basin: 2nd lake, *2998;* Setidgi Lake, *3111.*

Myriophyllum exalbescens, as elsewhere, appears to be more northern than *M. alterniflorum,* and in the Mackenzie Delta it may normally produce mature fruit.

UMBELLIFERAE

Bupleurum americanum Coult. & Rose.

Richardson Mts.: West of Mackenzie Delta, to 4000′ elev., *6705, 6844;* Mackenzie River Delta: East Branch, *7041;* Campbell Lake, *1942;* Richards Isl., *2108.*

A western species which has merely crossed the Mackenzie, not previously recorded from the Northwest Territories.

Cicuta mackenzieana Raup in Jour. Arn. Arb. **17**: 279, *pl. 197.* 1936.

Eskimo Lake Basin: Setidgi Lake, *3177.*

Not previously known in the district north of Great Slave Lake (*Raup*).

Conioselinum cnidiifolium (Turcz.) A. E. Porsild. See Rhodora **41**: 267. 1939.

This plant belongs in that group of western species that reach their eastern limit near the Mackenzie Delta, but, unlike most of these, it has penetrated a few hundred miles along the Arctic Coast to the mouth of the Anderson River (Liverpool Bay, *2914*). It is very common on sandy river banks in the Delta and is probably the plant which Richardson (Arctic Searching Exp. **1**: 233. 1851) reports under "Musenion divaricatum, East Branch, in lat. 68° 25′ on sandy banks."

CORNACEAE

Cornus canadensis L.

Great Bear Lake: Bear River, Mt. Charles, *3317, 3350, 3351.*

Hooker's statement, l. c., "Throughout Canada, nearly to the Arctic Coast, everywhere as far as the Pine woods extend.—*Richardson,*" certainly needs veri-

fication, especially as "Pine woods" here probably is intended to mean "coniferous woods." In the writer's experience, *C. canadensis* does not extend beyond the Canadian zone, and in the Mackenzie District it is limited to the Mackenzie Valley and Great Slave Lake.

Cornus stolonifera Michx.

GREAT BEAR LAKE: Bear River, Mt. Charles, forming thickets by a small stream, *3339*.

Unrecorded from the Northwest Territories, although specimens from Simpson and Norman, collected by Miss E. Taylor, are in the National Herbarium of Canada. Hooker's report, under *C. alba* L., "north to lat. 69°—*Richardson*," is certainly erroneous and is probably a misprint for "59°." Richardson, in Franklin's Journ. App. 732, says "W" (wooded country between lat. 54 and 64).

PYROLACEAE

Pyrola chlorantha Sw.

MACKENZIE RIVER: Sans Sault Rapids, *6570;* Bear Rock, Ft. Norman, *3389;* GREAT BEAR LAKE: Bear R., *3286;* Mt. Charles, *3335;* McTavish Arm, north shore, *5314;* Leith Pt., *3549*.

Rare or occasional in cold spruce woods, north in the Mackenzie basin to Ft. Norman and Bear Lake.

Pyrola minor L., Hook. Fl. Bor.-Am. **2:** 45. 1834; Simmons, Phytogeogr. Arct. Am. Arch. 115. 1913.

RICHARDSON MTS.: West of Mackenzie Delta, *7343;* MACKENZIE RIVER DELTA: East Branch, *6552;* GREAT BEAR LAKE: Etacho Pt., 1500′ elev., *3508;* Leith Pt., *3585, 3586*.

A rare species of peculiar and disrupted range. Hooker's statement, l. c., "Barren country from lat. 64° to the Arctic Coast and Islands," certainly is erroneous. Very questionable also is the record from Melville Peninsula, Simmons, l. c. The above are the first authentic collections in the Northwest Territories.

Pyrola secunda L.

MACKENZIE RIVER: Sans Sault Rapids, *6569*.

Pyrola secunda L. var. **obtusata** Turcz. See Porsild in Rhodora **41:** 274. 1939.

RICHARDSON MTS.: West of Mackenzie Delta, *6611;* MACKENZIE RIVER DELTA: East Branch, *6966;* Campbell Lake, *1943, 1944;* Richards Isl., *2262;* Kittigazuit Isl., *2381;* ARCTIC COAST: 6 mi. east of Kittigazuit, *2507;* Atkinson Pt., *2643;* Liverpool Bay, *2915;* ESKIMO LAKE BASIN: *3000, 3044;* GREAT BEAR LAKE: Ft. Franklin, *3223;* Bear R., *3319;* Cape McDonnel, *3156;* Dease Arm, Narakay Isl., *4848;* McTavish Arm, north shore, *5315;* south shore, *3633;* KEEWATIN DISTR.: Yathkyed Lake on Kazan R., *5838;* Lower Kazan R., *6060;* west coast of Hudson Bay, *5704*.

A species characteristic of northern coniferous woods but which, in the continental Northwest Territories, reaches far north of the limit of trees.

ERICACEAE

Loiseleuria procumbens (L.) Desv.

RICHARDSON MTS.: West of Mackenzie Delta, June 20, 1931, *O. Bryant;* GREAT BEAR LAKE: Dease Arm, north shore, *4707;* KEEWATIN DISTR.: Baker Lake, *6102;* Lake on Tha-anne R., *5594*.

A rare species in the Mackenzie District, limited to acid pre-Cambrian rocks.

Kalmia polifolia Wang.

GREAT BEAR LAKE: Keith Arm, *3429;* Etacho Pt., 1500′ elev., *3509;* KEEWATIN DISTR.: Lake on Tha-anne R., *5595*.

A plant of northern muskegs that in Keewatin extends some distance beyond the limit of trees; rare in the lower Mackenzie Basin, north to Bear Lake and in Central Yukon.

Phyllodoce coerulea (L.) Bab.

KEEWATIN DISTR.: Thelon R., *J. B. Tyrrell 15563, 23194* (Can); Thelon Sanctuary, *C. H. D. Clarke 808.*

An eastern species which reaches west to Central Keewatin.

Cassiope hypnoides (L.) D. Don.

KEEWATIN DISTR.: Thelon Sanctuary, *C. H. D. Clarke 804;* Maguse R., *W. Güssow 57.*

Like the preceding, an eastern species which reaches but a short distance west of Hudson Bay.

Chamaedaphne calyculata (L.) Moench.

RICHARDSON MTS.: West of Mackenzie Delta, *6614;* MACKENZIE RIVER DELTA: Aklavik, *7311;* Campbell Lake, *1953;* ESKIMO LAKE BASIN: *3006, 3047;* Setidgi L., *3114;* GREAT BEAR LAKE: McTavish Arm, *5249.*

Rare in the northern parts of the district, barely reaching to the edge of the timber.

Arctostaphylos alpina (L.) Spreng.

MACKENZIE RIVER DELTA: East Branch, *7276;* Kittigazuit Isl., *2385A;* ARCTIC COAST: Atkinson Pt., *2645;* ESKIMO LAKE BASIN: *3005;* GREAT BEAR LAKE: McTavish Arm, *5246;* KEEWATIN DISTR.: *Seton & Preble 78353* (Can); Thelon Sanctuary, *C. H. D. Clarke 817, 818.*

Occasional in acid sandy or gravelly places, chiefly on the pre-Cambrian rocks.

Arctostaphylos rubra (Rehd. & Wils.) Fern.

Very common on the Arctic Coast from Herschel Island east to Coronation Gulf and south to Great Bear and Great Slave Lakes, apparently preferring calcareous soil and for this reason best developed on the Palaeozoic rocks. The plant recorded by Simmons, l. c., 118, under *A. alpina,* from Banks and Victoria Islands, probably belongs here.

Oxycoccus microcarpus Turcz. See Porsild in Can. Field Nat. **52:** 116–117. 1938.

MACKENZIE RIVER DELTA: Campbell L., *1949;* ESKIMO LAKE BASIN: *3004;* GREAT BEAR LAKE: North shore, *5047;* Smith Arm, *5013;* McTavish Arm, north shore, *5245;* south shore, *3753;* KEEWATIN DISTR.: Yathkyed Lake on Kazan R., *5839.*

Common in sphagnum bogs of the forested country, extending but a short distance beyond the limit of trees.

DIAPENSIACEAE

Diapensia lapponica L.

KEEWATIN DISTR.: Yathkyed Lake on Kazan R., *5844;* Casba Lake, *Tyrrell 23114* (Can).

An eastern species which reaches but a short distance west of Hudson Bay.

Diapensia obovata (Fr. Schm.) Nakai. See Porsild in Trans. Royal Soc. Can. ser. 3, sect. 5, **32:** 35. 1938.

RICHARDSON MTS.: West of Mackenzie Delta, barren granite scree, 3000′ elev., *6708;* lower slopes, elev. 1500′, *6845, 7344.*

In the National Herbarium of Canada are several collections from central Yukon, but so far the species has not been collected east of the Mackenzie.

PRIMULACEAE

Primula borealis Duby. See Fernald in Rhodora **30:** 94. 1928.

GREAT BEAR LAKE: Dease Arm, north shore, *4713;* McTavish Arm, north shore, *5180.*

A western species common along the Arctic Coast eastward to Cape Bathurst; apparently rare in the interior.

Primula incana M. E. Jones. See Fernald in Rhodora **30**: 72. 1928.

Mackenzie River: Bear Rock, near Ft. Norman, *3390*.

Not previously recorded from north of Great Slave Lake.

Douglasia arctica Hook. Fl. Bor.-Am. **2**: 120. 1838; Ostenf. in Gjöa Exp. 60. 1909; Holm & Macoun in Rept. Can. Arct. Exp. **5A**: 18. 1921; Constance in Am. Midl. Nat. **19**: 258. 1938.

Arctic Coast of Yukon Territory: Shingle Pt., *6730;* between King and Kay Pts., *7193;* Richardson Mts.: West of Mackenzie Delta, between 3000 and 4000′ elev., *6617, 6709, 6710, 6846*.

Hooker's statement, l. c., "Arctic sea-shore, between the Mackenzie and Coppermine Rivers. *Dr. Richardson,*" needs confirmation, since the species has not since been collected east of the Mackenzie, whereas it is quite common on the Arctic Coast to the westward and on alpine slopes of the Richardson Mountains, where it is found only on snow-flushes. The flowers appear shortly after the snow melts and during anthesis are almost hidden among the leaves. Following anthesis the peduncles rapidly elongate to about 2 cm. When past flowering, the plant is very inconspicuous and, due to the reddish brown color of the marcescent leaves, looks like a tuft of "moss." The flowers vary considerably in size and color, from 0.5 to 1 cm. in diam., and from rose-pink to deep purple. The seeds are large (1.8 × 1.3 mm.), dull, black and wrinkled, two in each capsule.

GENTIANACEAE

Gentiana Amarella L.

Great Bear Lake: Bear R., *3369, 3370;* Etacho Pt., 1500′ elev., *3510;* Leith Pt., south shore, *3552*.

A southern species, previously collected but once north of Great Slave Lake.

Gentiana arctophila Griseb. in Hook. Fl. Bor.-Am. **2**: 61, *tab. 149*. 1838; Holm & Macoun, Rept. Can. Arct. Exp. **5A**: 19. 1921, in part.

Arctic Coast: Liverpool Bay, *2927;* Eskimo Lake Basin: *3072, 3073;* Great Bear Lake: McTavish Arm, north shore.

The above-cited specimens are a good match for Grisebach's description and plate. *Gentiana arctophila* is no doubt closely related to the widely distributed *G. propinqua,* but it is a much lower plant; well-developed specimens as a rule are freely branched from the base, with strongly ascending branches. The terminal flower is much larger than the lateral ones. The corolla is funnel-shaped; the lobes are elliptic, distinctly mucronate, half as long as the tube in the terminal flower while equaling it in the lateral ones. The seeds average 0.8 × 0.6 mm. and are short-elliptic, round, not flattened in cross-section, light brown, smooth, but not shiny.

Gentiana ? detonsa Rottb., Griseb. in Hook. Fl. Bor.-Am. **2**: 64. 1838, as regards plant of "Arctic Sea-shore" (as *G. detonsa* [Fries]). For discussion of the nomenclature, history, and identity of this plant see Morten P. Porsild in Medd. om Grønl. **93**[3]: 43–52. 1935.

Arctic Coast: Atkinson Pt., on a dry, sandy slope 8 miles from the coast, Aug. 1–3, 1927, *2653*.

Theo. Holm, who, in Ott. Nat. **15**: 175–183. 1901, revised the American members of the Section *Crossopetalae*, denied the presence in America of *G. detonsa* (*G. serrata* Gunn.), without, however, attempting to determine what plants

Grisebach, l. c., had had in mind. East of the Mackenzie Delta the writer, in 1927, collected a series of specimens of a gentian that in the field he at once identified with the *G. detonsa* with which he was familiar in Greenland. When compared with specimens from Greenland and Norway, it becomes apparent that the series differs somewhat from typical *G. detonsa*. In the Mackenzie plant the lobes of the corolla taper to a narrow point, whereas in the Greenland plant they are oblong and rather obtuse; also, the basal leaves in our plant are somewhat broader and more obtuse. Since the plant otherwise is a close match for typical *G. detonsa*, the writer, at least until further collections are made, prefers to retain it under this name.

Gentiana Raupii sp. nov.

Gentiana elegans sensu Raup in Nat. Mus. Can. Bull. **74**: 157. 1935, in Jour. Arn. Arb. **17**: 290. 1936, non Nels.

Gentiana procera sensu Porsild in Rhodora **41**: 279. 1939, non Holm.

Herba annua glaberrima, caules tenues, obscure purpurascentes, angulati, simplices vel e basi nodisque ramosi, 2–60 cm. alti; folia basalia oblanceolata, brevipetiolata; folia caulina opposita, 2- vel 3-juga, lineari-lanceolata, sessilia, subamplexicaulia; pedunculi longi, uniflori; calyx purpureo-viridis, fere ad medium fissus, lobi subaequales, lanceolati, acuminati, marginibus membranaceis, obscure carinatis glaberrimi; corolla tenuis, purpureo-cyanea, 1–4 cm. longa, 4-lobata, fere ad medium incisa, lobis oblongo-truncatis, margine fimbriatis, apice erosodentatis; glandulae nectariferae praesentes; stamina 4, filamentis glabris, dilatis vel infra alatis; stylus liber, latitudinem stigmatis semilunaris bilobati aequans; semina oblonga, papillis brevibus obtusis dense tecta.

Mackenzie River: Near Blackwater R., 62° 63′, alluvial clay banks, Sept. 17, 1931, *A. E. Porsild 6571* (type); ramparts below Good Hope, *3403; M. Jones*, 1903, *62299* (Can); Great Slave Lake: *C. F. Howe 91958* (Can); *G. S. Hume 102678* (Can); Wood Buffalo Pk.: *H. M. Raup 3026, 3028*, distr. as *G. elegans;* Alaska: Richardson Highway, between Summit and McCarthy, *A. E. & R. T. Porsild 440* (distr. as *G. procera*).

Gentiana Raupii is closely related to *G. procera, G. Macounii,* and *G. elegans,* but it differs from all in being less leafy and in the absence of the very characteristic papillose keels of the calyx-lobes; the style is longer than in the first two but much shorter than in *G. elegans;* from *G. detonsa* it may at once be distinguished by the fringed corolla-lobes.

It appears to be common in the Mackenzie Basin in alluvial meadows and on clay banks. In the type locality flowering and fruiting specimens were collected together.

Gentiana glauca Pall.

Richardson Mts.: West of Mackenzie Delta, *6618, 7345.*

Not previously recorded from the Northwest Territories.

Lomatogonium rotatum (L.) Fries.

Pleurogyne rotata (L.) Griseb., Holm & Macoun in Rept. Can. Arct. Exp. **5A**: 19, *tab. XI, fig. 3.* 1921.

Pleurogyne Carinthiaca sensu Holm & Macoun, ibid., non Wulf. See Fernald in Rhodora **21**: 197. 1919.

Arctic Coast of Yukon Territory: Shingle Pt., *7113;* Arctic Coast: West of Mackenzie, Tuktuayaktoq, *7437;* Atkinson Pt., *2654;* Cape Dalhousie, *2789;* Kugaruk, west of Anderson R., *3087;* Great Bear Lake: McTavish Arm, north shore, vicinity of cold mineral spring, *5183.*

Our specimens from the Arctic Coast west of the Mackenzie match the plant which Holm and Macoun referred to *P. Carinthiaca.* It differs from typical *L.*

rotatum in its shorter and broader calyx-lobes, its slender and less strict growth, and in its smaller seeds; these are dark brown and average 0.4 × 0.2 mm. as compared with 0.6 × 0.3 mm. in typical *L. rotatum* (in *P. Carinthiaca,* according to Hegi, Fl. Mitteleur. 5[3]: 1977, 0.5–0.7 × 0.3–0.5 mm.). Our plant also is not halophilous but, like *Gentiana propinqua* and *G. arctophila,* grows in herb mats, often far from the sea-shore.

In view of the polymorphism in *L. rotatum,* I am here, with Fernald, l. c., maintaining the plant under this name.

Menyanthes trifoliata L.

Mackenzie River Delta: Campbell Lake, *1956;* Arctic Coast: East of Kittigazuit, *2514;* Eskimo Lake Basin: Setidgi L., *3117;* Great Bear Lake: McTavish Arm, east shore, *3754, 5355;* north shore, *5250;* north shore, Haldane R., *5049;* Keewatin Distr.: Yathkyed Lake on Kazan R., *5842.*

Somewhat rare in the wooded country, occasionally extending beyond the limit of trees. In the Mackenzie District *M. trifoliata* is a late-flowering species which matures fruit only in favorable seasons. Compare also Fernald, in Rhodora **31**: 105. 1929, and Porsild, ibid. **41**: 281. 1939.

POLEMONIACEAE

Phlox Richardsonii Hook. Fl. Bor.-Am. **2**: 73, *tab. 160.* 1838; Holm & Macoun, Rept. Can. Arct. Exp. **5A**: 19. 1921.

Richardson Mts.: West of Mackenzie Delta, 2500–3000′ elev., *6712.*

Our plants grew on volcanic tufa and formed large, loose mats. The leaves are lanceolate, not subulate, and the flowers are large, 1.5 to 2 cm. in diameter.

Polemonium acutiflorum Willd. See Hultén, Fl. Kamtch. **4**: 72. 1930.

Polemonium coeruleum L. var. *villosum* (Rud.) Brand, Ostenf. in Gjöa Exp. 62. 1909; Holm & Macoun in Rept. Can. Arct. Exp. **5A**: 19. 1921.

Richardson Mts.: West of Mackenzie Delta, *6619, 6713, 6848;* Arctic Coast of Yukon Territory: Shingle Pt., *6909, 7112;* King Pt., *7194;* Mackenzie River Delta: Richards Isl., *2276;* Arctic Coast: Liverpool Bay, *2928.*

Polemonium acutiflorum is an Asiatic species which in western America reaches but a short distance east of the Mackenzie. It inhabits moist, fertile slopes and snow-flushes, where it flowers late and in some seasons does not mature seed.

Polemonium pulcherrimum Hook. in Bot. Mag. **57**: *tab. 2979.* 1830; Brand in Pflanzenr. 27 (IV. **250**): 34. 1907.

Mackenzie River Delta: Campbell Lake, *1959;* East Branch, *7043;* Eskimo Lake Basin: *6937;* Great Bear Lake: Etacho Pt., 1500′ elev., *3511.*

Our plants match a large series in the National Herbarium of Canada from Yukon Territory, Alaska, and British Columbia, lying mostly under *P. humile.* Although Hooker himself, in Fl. Bor.-Am., reduced *P. pulcherrimum* to an unimportant variation of *P. coeruleum,* there can be little doubt that the plant is abundantly distinct. *Polemonium pulcherrimum* apparently is restricted to calcareous soils. We collected it on ledges of limestone cliffs, where it flowers very early. The plant is very viscid and fetid of odor. The flowers are much smaller than in *P. acutiflorum,* while the seeds are quite wingless and more or less lustrous. The plant from Bear Lake differs somewhat by its larger flowers and by being less viscid.

BORAGINACEAE

Lappula Redowskii (Hornem.) Greene var. **occidentalis** (Wats.) Rydb.

Eskimo Lake Basin: *3050.* Previously known in the district northward to Great Bear Lake.

Eritrichium aretioides (Cham. & Schlecht.) DC.

Arctic Coast of Yukon Territory: Between King and Kay Pts., *7159.*

A rare plant, known in North America from a few places in arctic Alaska and Yukon Territory. See Porsild in Rhodora **41**: 282. 1939, where first recorded from Canada.

Mertensia paniculata (Ait.) G. Don. See L. O. Williams in Ann. Mo. Bot. Gard. **24**: 42. 1937.

Mertensia pilosa (Cham.) G. Don, Ostenf. in Gjöa Exp. 63. 1909.

Arctic Coast of Yukon Territory: Between King and Kay Pts., *7192,* where previously collected by the Gjöa Expedition.

The record in Fl. Bor.-Am., under *Lithospermum paniculatum,* from Great Bear Lake, needs confirmation.

LABIATAE

Stachys palustris L.

Mackenzie River: Lat. 62° 30′, *6564.* Common in the upper Mackenzie basin and recorded in Fl. Bor.-Am. from Great Bear Lake.

Greene, Pitt. 3: 342. 1898, has proposed the name *S. scopulorum* for the western plant. Rydberg and most recent writers have taken up that name, but the plant of Alaska and Mackenzie, at least, seems inseparable from the almost circumpolar *S. palustris* L.

SCROPHULARIACEAE

Limosella aquatica L.

Great Bear Lake: McTavish Arm, east shore, *5357;* south shore, *3684, 3708.*

Our specimens grew in small, shallow ponds on granite hills and were in fruit the second week of August. The seeds are 0.6 to 0.7 mm. long and conspicuously transversely wrinkled. Although perhaps often overlooked, *L. aquatica* is a rare plant in Canada and has been collected but a few times from southern Labrador to British Columbia. Previously known north to Lake Athabaska and Churchill, Man. (*A. E. Porsild 5499*).

Veronica alpina L. var. **unalaschcensis** Cham. & Schlecht. See Fernald in Rhodora **41**: 447–457. 1939.

Veronica Wormskjoldi Roem. & Schult.

Great Bear Lake: Etacho Pt., 1500′ elev., *3512;* Keewatin Distr.: Lake on Tha-anne R., *5600.*

New to the flora of the Mackenzie and Keewatin Districts.

Lagotis Stelleri (Cham. & Schlecht.) Rupr.

Gymnandra Stelleri (Cham. & Schlecht.) Hook. Fl. Bor.-Am. **2**: 102. 1838.

Lagotis glauca Gärtn., Ostenf. in Gjöa Exp. 66. 1909.

Lagotis glauca Gaertn. var. *Stelleri* Cham. & Schlecht., Macoun & Holm in Rept. Can. Arct. Exp. **5A**: 20. 1921.

Arctic Coast of Yukon Territory: King and Kay Pts., *7198;* Richardson Mts.: West of Mackenzie Delta, wet alpine tundra, between 2000′ and 4000′ elev., *6715, 6850.*

A western species which barely reaches the Mackenzie River. See also Porsild in Rhodora **41**: 283–284. 1939.

Castilleja hyperborea Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 532. 1934; see also Porsild in Rhodora **41**: 284. 1939.

Richardson Mts.: West of Mackenzie Delta, dry, sandy ridges, 800'–2000' elev., *6851;* Mackenzie River Delta: Campbell Lake, gravelly limestone plateau.

Apparently an endemic species of Alaska and Yukon Territory, which has reached the eastern bank of the Mackenzie Delta.

Castilleja pallida (L.) Spreng. ssp. **caudata** Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 524. 1934.

Castilleja septentrionalis Hook. Fl. Bor.-Am. **2**: 105. 1838, at least as regards plant of "Arctic Sea-coast."

Castilleja pallida (L.) H. B. K., Ostenf. in Gjöa Exp. 64. 1909; Simmons, Phytogeogr. Arct. Am. Arch. 122. 1913.

See also Porsild in Rhodora **41**: 285. 1939.

Arctic Coast of Yukon Territory: Common between King and Kay Pts., *7160;* Mackenzie River Delta: Husky R., *6623;* Campbell L., *2010.*

The plant recorded from Banks and Victoria Islands by Simmons (as var. *septentrionalis*) probably belongs here. Apparently an endemic species of Alaska and Yukon Territory, which reaches east to the Mackenzie Delta and north to Banks Island.

Castilleja pallida (L.) Spreng. ssp. **elegans** (Ostenf.) Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 526. 1934.

Castilleja elegans Ostenf. in Rhodora **36**: 187. 1934.

Castilleja pallida (L.) Spreng. var. *unalaschkensis* sensu Ostenf. in Gjöa Exp. 64. 1909, non Cham. & Schlecht.

See also Porsild in Rhodora **41**: 285–286. 1936.

Eskimo Lake Basin: Narrows between 3rd and 4th lakes, *3049;* Arctic Coast: Cape Dalhousie, *2790;* Liverpool Bay, *2929;* Great Bear Lake: Dease Arm, Narakay Isl., *4851;* Keewatin Distr.: Mistake Bay, *5721.*

The above series differs from the typical plant in being densely caespitose, often forming large, dense clumps, and in having long yellow wool in the inflorescence.

The subspecies *elegans* is common from the north shore of Alaska to Hudson Bay on the "barren grounds" north of the wooded country. It is not a truly arctic species, however, and seems best developed in the southern parts of its range.

Castilleja pallida (L.) Spreng. ssp. **typica** Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 522. 1934.

Mackenzie River Delta: Richards Isl., *2119, 2273;* Arctic Coast: 6 miles east of Kittigazuit, *2515;* Atkinson Pt., *2655;* Great Bear Lake: North shore, Haldane R., *4963A;* McTavish Arm, north shore, *5159, 5184.*

The above series is rather uniform. The stems are few and ascending from a weak base, puberulent throughout; the leaves are puberulent, narrow, and entire; the inflorescence is short and not very woolly.

The ssp. *typica* is common in sandy places along the Arctic Coast and south to Great Bear Lake, thus covering practically the same range as ssp. *elegans.*

Castilleja Raupii Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 528. 1934, fig. on p. 529; Raup in Jour. Arn. Arb. **17**: 294. 1936.

Keewatin Distr.: Yathkyed Lake on Kazan R., *5845.*

Apparently common from Hudson Bay west to the upper Mackenzie Basin. In the Keewatin District it is a late-flowering southern species.

Castilleja Raupii ssp. **ursina** Pennell in Proc. Acad. Nat. Sci. Phil. **86**: 530. 1934.

MACKENZIE RIVER DELTA: Richards Isl., *2119A;* Kittigazuit Isl., *2310;* East Branch, *7045.*

The ssp. *ursina* appears to be more branched than any other northern member of the genus. It seems to be an endemic of the Mackenzie Valley, and the type came from Great Bear River (*Miss E. Taylor 86,* Can).

Castilleja septentrionalis Lindl. in Bot. Reg. **11**: *tab. 925.* 1825; Pennell, Scroph. of E. & Temp. N. Am. 553. 1935.

Castilleja pallida var. *septentrionalis* (Lindl.) Gray, Syn. Fl. N. Am. **2**[1]: 297. 1886.

GREAT BEAR LAKE: Etacho Pt., 1500′ elev., *3513;* north shore, near Haldane R., *4963.*

An eastern species common in temperate and boreal Atlantic North America, west to James Bay and north to southern Baffin Island, with isolated stations west to Alberta. The above stations from Bear Lake constitute the first authentic records from the continental Northwest Territories.

Euphrasia disjuncta Fern. & Wieg. in Rhodora **17**: 190. 1915.

GREAT BEAR LAKE: Bear River, *3271, 3371.*

Erroneously recorded from the Northwest Territories (Mackenzie District) by Fernald & Wiegand, l. c., based upon Dawson's collection from Lewes R., in the Yukon Territory (*17449,* Can). *Euphrasia disjuncta* is a bicentric species known from Atlantic North America and from the Alaska-Yukon region; the above collection extends the range to the Mackenzie District.

Rhinanthus groenlandicus Chab.

MACKENZIE RIVER: Near Root R., 62° 30′ N., *6562.*

Pedicularis arctica R. Br. Chlor. Melv. 32. 1823. For synonymy see Simmons, Vasc. Pl. Ellesmereland 30. 1906, and Hultén, Fl. Kamtch. **4**: 116–118. 1930.

Since Brown's name was published there has been much confusion with regard to its proper application. Some writers have considered it a synonym of *P. Langsdorffii* Fisch. ex Stev., while others have considered the plant of arctic Canada a race or variety of the Bering Sea plant. Much of the uncertainty seems to have centered around the question of which name held priority in point of date of publication, and the actual identity of the two plants seems to a large extent to have been neglected.

To the writer, who is familiar with both plants in the field, it seems most natural to consider them specifically distinct, even though phylogenetically related. Simmons, l. c., has pointed out that *P. arctica* "shows great resemblance in habit" to *P. hirsuta.* As a matter of fact, specimens of *P. hirsuta* with bidentate galea are not uncommon in northwestern Greenland and have even been observed in material from arctic Europe (Torne Lappmark, Jukkasjarvi Tesivara, 750 m., July 11, 1926, *G. Alm,* Can). Other characters also, including those of the fruits, show that *P. arctica* and *P. hirsuta* are really very closely related, although according to the arrangement used by most monographers of the genus they should be placed in separate sections. It would thus appear to be as logical to consider *P. arctica* a race or variety of *P. hirsuta* as *P. Langsdorffii.*

Pedicularis arctica is a common species along the shores of the Arctic Ocean and of the Arctic Archipelago, reaching the extreme northwest corner of Greenland. Although not a littoral species, it seems to be absent in the interior of the Mackenzie and Keewatin Districts.

Pedicularis flammea L.

GREAT BEAR LAKE: Keith Arm, Deerpass Bay, *3464;* Dease Arm, north shore, *4715, 4716, 4903;* south shore, Leith Pt., *3590;* KEEWATIN DISTR.: Yathkyed L. on Kazan R., *5847;* Baker L., *6128.*

An eastern species which in the Northwest Territories reaches to Bear Lake with an isolated station in Alaska.

Pedicularis hirsuta L.

An eastern species which reaches only to the west shore of Hudson Bay. Hooker (Fl. Bor.-Am.) clearly did not understand the genus well, and his record of *P. hirsuta* from Bear Lake needs confirmation.

Pedicularis lapponica L., Macoun & Holm in Rept. Can. Arct. Exp. **5A**: 19. 1921.

Richardson Mts.: West of Mackenzie Delta, *6622;* Mackenzie River Delta: East Branch, *6883;* Great Bear Lake: Dease Arm, Narakay Isl., *4850;* north shore, Haldane R., *4964;* Keewatin Distr.: Yathkyed Lake on Kazan R., *5864;* Lake on Tha-anne R., *5601.*

An eastern species, in our district rare or occasional west to the Mackenzie Delta. Previously known in the Mackenzie District only from a single collection in Coronation Gulf (*Can. Arct. Exp.*).

OROBANCHACEAE

Boschniakia rossica (Cham. & Schlecht.) B. Fedtsch.

Orobanche glabra Hook. Fl. Bor.-Am. **2**: 92. 1838.

Mackenzie River Delta: Husky R., *6624;* East Branch, *7047;* Richards Isl., *2120;* Eskimo Lake Basin: *3012;* Great Bear Lake: Bear R., Mt. Charles, *3352;* McTavish Arm, east shore, *3770, 5319;* south shore, *3609, 3635.*

Common in northern parts of the Mackenzie District in open spruce woods and alder thickets, extending north to the limit of trees. Previously recorded from Great Bear Lake by Hooker, l. c.

LENTIBULARIACEAE

Pinguicula villosa L.

Richardson Mts.: West of Mackenzie Delta, *6856;* Mackenzie River Delta: Richards Isl., *7077;* Campbell Lake, *1961;* Arctic Coast: 6 miles east of Kittigazuit, *2521;* Eskimo Lake Basin: 2nd lake, *3014;* Setidgi Lake, *3167;* Great Bear Lake: McTavish Arm, east shore, *5358;* Keewatin Distr.: Yathkyed Lake on Kazan R., *5841.*

Rare or occasional in sphagnum bogs of the wooded country north to the limit of trees or slightly beyond. Previously recorded from Great Slave Lake (*Raup*).

Utricularia intermedia Hayne.

Mackenzie River Delta: Pt. Separation, *1940;* Richards Isl., north end, *2275,* flowering specimens collected July 22, 1927; Eskimo Lake Basin: 2nd lake, *2013,* flowering specimens collected Aug. 18, 1927; Great Bear Lake: Smith Arm, north shore, *5015;* Dease Arm, north shore, *4722;* McTavish Arm, north shore, *5282;* south shore, *3647;* Leith Pt., *3553;* Keewatin Distr.: Lake on Tha-anne R., *5598.*

Previously known in our region northward to Great Bear Lake (*Richardson*). In this district *U. intermedia* flowers and probably also fruits in favorable seasons.

Utricularia minor L.

Great Bear Lake: North shore near Haldane R., *5051;* McTavish Arm, north shore, *5283;* Leith Pt., *3547.*

Previously known in this district northward to Great Slave Lake (*Raup*). All specimens were sterile.

Utricularia ochroleuca Hartm.

Mackenzie River Delta: South end of Richards Isl., 69° N., 134° 40′ W., with green algae in a wet *Carex* bog, July 22, 1934, *7076.*

Utricularia ochroleuca was first recorded from North America west of Greenland by Lily M. Perry, in Rhodora **33**: 124. 1931, who collected it on St. Paul

Island, N. S. Our specimens, like those of Dr. Perry, are sterile, but the characteristic shape and denticulation of the leaf-segments, the winter buds, and the presence of bladders on the immersed leaf-bearing stems make the determination quite certain.

Actually the first collection of *U. ochroleuca* in Canada came from the north shore of the Gulf of St. Lawrence, Saguenay Co., Quebec, Natashquan, Aug. 7, 1927, *H. F. Lewis* (Can) (distributed as *U. intermedia*).

Utricularia vulgaris L. var. **americana** Gray.

Mackenzie River Delta: East Branch, sterile but with large winter buds on Aug. 4, *7240, 7289;* Eskimo Lake Basin: Setidgi Lake, *3116, 3166;* Great Bear Lake: McTavish Arm, north shore, flowering specimens on Aug. 6, *5251.*

All of these specimens except the last were sterile and the species probably does not flower or fruit except in favorable years. Previously known in the district northward to Great Slave Lake (*Raup*).

PLANTAGINACEAE

Plantago eriopoda Torr.

Arctic Coast: Tuktuayaktoq, *7438.*

As pointed out by Raup (in Jour. Arn. Arb. **17**: 297. 1936), Macoun's reference (Cat. 2: 392) to material from the "Arctic Sea" probably refers to *P. septata* Morris, and *P. eriopoda* is thus new to the flora of our region.

Plantago juncoides Lam. var. **glauca** (Hornem.) Fern. in Rhodora **27**: 101. 1925.

Mackenzie River Delta: Husky R., June 20, 1931, *O. Bryant* (Can); Great Bear Lake: McTavish Arm, north shore, by a salt spring, *5187.*

Apparently new to the flora of our region.

Plantago septata Morris in Bull. N. Y. Bot. Gard. **2**: 182. 1901.

Plantago lanceolata β Hook. Fl. Bor.-Am. **2**: 123. 1838; Macoun & Holm, Rept. Can. Arct. Exp. **5A**: 20. 1921.

Mackenzie River Delta: East Branch, *7048;* Campbell Lake, *1963, 1964;* Kittigazuit Isl., *2396;* Arctic Coast: Cape Dalhousie, *2796;* Liverpool Bay, *2935;* Great Bear Lake: Bear River, *3394;* Dease Arm, north shore, *2723;* Dease Valley, *4852.*

In our district *P. septata* grows in dry calcareous soil. Our specimens well match the description. Rydberg (Fl. Rocky Mts.) states in his key: "plant not woolly at the base," but in the text he says "woolly, especially below," which is correct. Morris, l. c., says: "seeds two." In our material the capsule is as often 3-locular with one seed in each compartment.

Plantago septata appears to be common in Yukon Territory and northwestern Mackenzie. It reaches east to Coronation Gulf and south to the mountains of Alberta and Montana. The species was described from central Yukon Territory, not "Alaska," as stated in the Gray Index. Unlike *P. eriopoda,* it is nonhalophytic.

RUBIACEAE

Galium boreale L.

Mackenzie River Delta: Campbell Lake, *1962, 2016;* Great Bear Lake: Bear R., Mt. Charles, *3338, 3353;* Porcupine R., *3372.*

Galium Brandegei Gray. See Porsild in Rhodora **41**: 289. 1939.

Mackenzie River Delta: Husky R., *7346;* Eskimo Lake Basin: Setidgi L., *3118;* Great Bear Lake: McTavish Arm, east shore, *3699, 3709;* south shore, *4879;* Keewatin Distr.: Lake on Tha-anne R., *5599.*

A common species in wet *Carex* bogs and on the margins of ponds and sloughs of the lowland, reaching north to the limit of trees or slightly beyond. Not previously recorded from the Northwest Territories.

Galium trifidum L.

Mackenzie River Delta: Aklavik, *7313;* Eskimo Lake Basin: 2nd lake, *3015;* Great Bear Lake: Keith Arm, Deerpass Bay, *3444;* Mackenzie River: Above Sans Sault Rapid, *3401.*

A southern woodland species in our district, rare or occasional in favorable places north to the tree limit. Previously known northward to Ft. Smith (*Raup*).

CAPRIFOLIACEAE

Viburnum edule (Michx.) Raf.

Mackenzie River Delta: Campbell Lake, *2014;* Eskimo Lake Basin: Setidgi Lake, *3165;* Great Bear Lake: Bear R., *3246;* McTavish Arm, *3755, 5252, 5317.*

Occasional on the lower Mackenzie and at Great Bear Lake.

VALERIANACEAE

Valeriana capitata Pall.

Valeriana bracteosa Britt. in Bull. N. Y. Bot. Gard. **2**: 183. 1901.

Richardson Mts.: West of Mackenzie Delta, *6721, 6858;* Arctic Coast of Yukon Territory: King Pt., *7156;* Mackenzie River Delta: Aklavik, *1965;* Richards Isl., *2278.*

An Asiatic species common in Alaska and Yukon, and having its eastern limit at the Mackenzie Delta; Hooker's statement, "Between the Coppermine and Mackenzie Rivers," needs confirmation. The plant of the interior is taller and the inflorescence is less "capitate" (*V. bracteosa* Britt.), but it differs in no other way from *V. capitata.* The species is not truly arctic, and north of the limit of trees it does not normally produce mature fruits.

Valeriana septentrionalis Rydb.

Great Bear Lake: Etacho Pt., 1500′ elev., *3514.*

Not previously recorded from the Northwest Territories.

CAMPANULACEAE

Campanula uniflora L.

Richardson Mts.: West of Mackenzie Delta, *6859.*

A species of peculiar and disrupted range, common in the Eastern Arctic west to Keewatin, in the Arctic Archipelago, and along the Arctic Coast west to Coronation Gulf. Apparently absent in Yukon Territory, with an isolated station in the Richardson Mts.

COMPOSITAE

Aster alpinus L. spp. **Vierhapperi** Onno in Bibl. Bot. **26**[Heft 106]: 25, *tab. 6, fig. 4.* 1932.

Great Bear Lake: Bear River, dry slopes near summit of Mt. Charles, *3340;* Bear Rock, 1300′ elev., *3379;* Smith Arm, north shore, *3087.*

This is *A. alpinus* of some American authors but not of Linnaeus; it is closely related to *A. culminis* A. Nels., placed by Rydberg under *A. alpinus.* From *A. alpinus* of Europe it differs in having the stem glandular below the head, the basal leaves 1-nerved, the bracts more obtuse and purple-tipped, and the rays pure white, not golden yellow or rose.

Onno's description, l. c., is so brief that the plant can hardly be recognized by it, but the plate, as well as specimens annotated by Onno in the Gray Herbarium, leave no doubt as to which plant is meant.

Our plant may be described as follows: Perennial from a branching, stout, subligneous rootstock; basal leaves numerous, oblanceolate, obtuse, 3–6 cm. long, 0.5–0.7 cm. wide, 1-nerved; cauline leaves 5–8, linear, the upper ones much reduced. Leaves, stems, and bracts invested with very short, scattered strigose hairs, both surfaces of the leaves in addition covered with pale yellowish resinous dots, visible under 25 × magnification. Stems few, stiffly erect, not at all ascending, 10–15 (–25) cm. high, dark green with conspicuous reddish ribs; heads solitary, large, 3–4 cm. in diam., 1.5 cm. high; bracts 0.7 cm. long, obtuse, prominently tipped and margined with purple; ligules 1–1.4 cm. long and about 0.2 cm. wide, white and papery; achenes flat, cuneate, about 0.3 cm. long, strigose; pappus sordid, simple. The entire plant in life is viscid-mealy to the touch and the flowering heads are very showy.

Distribution: Mountains of Alberta, with isolated stations in Alaska, Yukon, and at Great Bear Lake.

Aster Lindleyanus T. & G.

Great Bear Lake: Bear R., Mt. Charles, *3344.*

Only sterile leaf-rosettes could be found and the species may not flower and fruit here except in favorable years. Previously known northward to Great Slave Lake (*Raup*).

Erigeron acris L. var. **asteroides** (Andrz.) DC.

Great Bear Lake: Keith Arm, Russel Bay, *3413;* Dease Arm, north shore, *4726, 4816;* McTavish Arm, *3612, 3687, 3756.*

Erigeron compositus Pursh.

Mackenzie River Delta: East Branch, *6895, 7006, 7058;* Campbell Lake, *2018;* Arctic Coast: Kittigazuit Isl., *2403;* Atkinson Pt., *2662;* Cape Dalhousie, *2802;* Liverpool Bay, *3091;* Great Bear Lake: Dease Arm, Narakay Isl., *4855;* Smith Arm, north shore, *5020;* McTavish Arm, north shore, *5318.* In addition to the numbers listed above, which are all typical, the following belong to the var. *trifidus* (Hook.) Gray: Great Bear Lake: Bear R., Mt. Charles, *3442;* McTavish Arm, south shore, *3637, 3659.*

Erigeron eriocephalus J. Vahl.

Arctic Coast: Atkinson Pt., *2663;* Cape Dalhousie, *2803;* Coppermine R., *A. M. Berry 22, 23* (Can); Mackenzie Distr.: Thelon R., 63°–64° N., *J. W. Tyrrell 106115* (Can).

Our specimens are a good match for typical plants from Greenland.

Erigeron grandiflorus Hook. Fl. Bor.-Am. **2:** 18, *tab. 123.* 1834.

Mackenzie River Delta: Campbell Lake, *1970, 2019;* Arctic Coast: Cape Dalhousie, *2804;* Liverpool Bay, *2940, 2950.*

A western species of Alaska and Yukon which reaches eastward along the Arctic Coast to Anderson R., and in the mountains south to high peaks of Alberta.

Antennaria angustata Greene, Pitt. **3:** 284. 1898; Malte in Rhodora **36:** 115. 1934; Polunin, Bot. Can. E. Arct. 347. 1940.

Antennaria nitens Greene in Ott. Nat. **25:** 42. 1911.

Keewatin Distr.: Lake on Tha-anne R., *5604, 5605.*

In its typical form, *A. angustata* is a well-marked species common in W. Greenland, S. Baffin Island, N. Labrador, and the Hudson Bay region. In Keewatin the species becomes rare and less typical. A form which puzzled both Malte and Polunin is *A. nitens* Greene, collected in Wager Inlet by *J. M. Macoun (79269,* type, Can). It consists of three rather poor individuals collected on Sept. 8, 1910. In the discussion following the description, Greene, l. c., adds: "quite past flowering . . . and had even shed most of their pappus, enough of which has remained, however, to show their very marked character of being

almost plumose in the middle and upper portion . . . I can hardly doubt that the plants are all staminate. The appearance of the involucres seem to indicate this, as well as the subplumose pappus."

The three aforementioned specimens, now at any rate, show no single trace of pappus or achenes, and it is evident that Malte, l. c., when copying Greene's diagnosis, overlooked the discussion; hence his remark, l. c., "only the female plant known." Until better material is available, *A. nitens* is perhaps best treated as a form of *A. angustata,* which, through age, has become almost entirely glabrous.

In the National Herbarium of Canada are four sheets of a plant from high mountains of Alberta and British Columbia: Alberta: Forget-me-not Mt., *J. Macoun 18497;* Lake Louise, *J. M. Macoun 65428;* British Columbia: Skagit R., *J. M. Macoun 69336,* and Columbia R., *Spreadborough 19658.* These were labelled by Greene with a name which apparently was never published, while they were referred by Rydberg to *A. monocephala.* All of these, no doubt, should be referred to *A. angustata* Greene.

Antennaria canescens (Lange) Malte in Rhodora **36:** 109. 1934.

Antennaria alpina (L.) Gaertn. *β canescens* Lange, Fl. Dan. **16:** *tab. 2786, fig. 1–3.* 1869.

Keewatin Distr.: West coast of Hudson Bay, Mistake Bay, *5723;* Yathkyed Lake on Kazan R., *5854;* lower Kazan R., *6068.*

Antennaria canescens appears to be a well-marked species of Greenland, S. Baffin Island, northern Labrador, and the Hudson Bay region, reaching west only to central Keewatin.

Antennaria compacta Malte in Rhodora **36:** 111. 1934.

Antennaria candida sensu Macoun & Holm in Rept. Can. Arct. Exp. **5A:** 21. 1921, non Greene.

Arctic Coast: Cape Dalhousie, *2801;* Great Bear Lake: Bear R., Mt. Charles, 1500′ elev., *3306, 3347;* Dease Arm, Narakay Isl., *4853;* McTavish Arm, north shore, *5210.*

The plants from Great Bear Lake are almost pulvinate with short and rather broad, almost imbricate basal leaves; the flowering stems are 10–15 cm. high. The achenes are glabrous.

Antennaria crymophila sp. nov.

Planta rhizomate brevi percrasso subligneo praedita, rosulas implicatas numerosas steriles sessiles edens; folia basalia spathulata, obtusa, 1 cm. longa, 0.3 cm. lata, per annos persistentia, utrinque conferte adpresse albo-tomentosa, adulta plumbaginea; rami florigeri ca. 10 cm. alti, rigidi, tomento ablato atro-brunnei, folia caulina 6–8 sat remota valde diminuta apice scariosa gerentes; corymbus laxiflorus, corymbulis 4 pro ratione magnis longe pedunculatis constans; involucrum ca. 0.6 cm. longum, bractearum seriebus 4 vel 5, bracteis basi evidenter atris, apice obtusis, pallide stramineis, pappo subrufo; styli vix exserti; nuculae maturae olivaceae setulis paucis at conspicuis indutis; planta mascula ignota.

Mackenzie River Delta: East Branch, 68° 55′ N., dry, gravelly places, July 21, 1934, *A. E. Porsild 7053* (type).

Antennaria crymophila is a well-marked species of the Sect. *Dioicoideae* (Sched.), perhaps most closely related to *A. pulvinata* Greene of the mountains of Alberta and British Columbia, but differing from it in the open corymbs, taller habit, and strongly developed rootstocks. Thus far known only from the type locality.

Antennaria Ekmaniana nom. nov.

Antennaria angustifolia E. Ekman, Sv. Bot. Tidskr. **21:** 53, *tab. 1, figs. 1, 2, 12.* 1927, non Rydb. in Bull. Torr. Bot. Cl. **26:** 546. 1899.

Antennaria Friesiana sensu E. Ekman, ibid. **22**: 416. 1928, as to plant discussed, not as to type, *A. alpina* var. *Friesiana* Trautv. in Acta Hort. Petrop. **6**: 24. 1878.

Antennaria labradorica sensu Fern. in Rhodora **33**: 223. 1931, non Nutt. in Trans. Am. Phil. Soc. new ser. **7**: 406. 1841; sensu Malte in Rhodora **36**: 112. 1934; sensu Polunin, Bot. Can. E. Arct. 350. 1940.

The late Mrs. Elizabeth Ekman, l. c., under *A. angustifolia,* described and illustrated a plant which had formerly passed as *A. alpina* (L.) Gaertn. in Greenland and in North America. Unfortunately the name chosen, which so well described the plant, was preoccupied by *A. angustifolia* Rydb. *Antennaria Friesiana,* based upon *A. alpina* var. *Friesiana* Trautv., as first suggested by Fernald, l. c., and later definitely proved by Malte, l. c., was an unfortunate substitution. Fernald further suggested that Ekman's plant is probably the long obscure *A. labradorica* Nutt., of which he discovered fragments thus labeled in the British Museum of Natural History, London. In his posthumously published revision of the arctic species of *Antennaria,* Malte, without contributing any new proof, accepted Fernald's interpretation of Ekman's plant.

The plant which Nuttall described as *A. angustifolia* came from the herbarium of Schweinitz, who was bishop of the Moravians, and who undoubtedly had received it from missionaries in Labrador, whereas Ekman's plant is truly arctic and, as far as the writer is aware, has not been collected in Labrador proper.

Nuttall's diagnosis is very brief but it contains several statements which seem to show that he could not possibly have had the narrow-leaved, rhizomatous arctic plant in mind. Thus, "sarments procumbent, flowering" generally would be understood to mean long, slender runners, and Nuttall would hardly have used that term if he had wished to describe the sessile innovations so characteristic for the arctic plant. Malte, l. c., 103, who himself stressed the taxonomic importance in this genus of the "presence or absence of stolons," in the Latin diagnosis of some of his new species translated "basal offshoots" with "sarmentis," even where sessile innovations were meant. This certainly is very misleading and "innovationes" perhaps would have been a more correct term.

Nuttall further describes his *A. labradorica* as having "radical leaves spathulate-linear," whereas our plant has the narrowest leaves of all arctic species. Of the cauline leaves Nuttall says, "at length nearly smooth," while in our plants they are permanently lanate, as stated by Malte, l. c.

The identity of our plant with that of Nuttall becomes even more problematical when we read Nuttall's discussion, in which he says: "Apparently a very distinct species. At first glance resembling *A. alpina,* but more nearly allied to *A. plantaginea;* it is, however, a much smaller plant, the leaves not three-nerved . . .; the achenium is also perfectly smooth; . . ." In view of Nuttall's comparison of his species with *A. plantaginea,* Malte's remark, l. c., 144, loses some of its point when he states that Greene made "a wild guess" when (Pitt. **3**: 185), under *A. neodioica,* he ventured the suggestion that Nuttall with his *A. labradorica* might have meant that species. As a matter of fact, some specimens of *A. neodioica* var. *gaspensis* Fern. in the National Herbarium of Canada match Nuttall's description of *A. labradorica* much better than does the narrow-leaved, non-stoloniferous *A. angustifolia* of Ekman. The same may be said of *A. spathulata* Fern. and *A. appendiculata* Fern.

Malte also claimed that Greene (Pitt. **3**: 285) "made another unfortunate guess at the identity of Nuttall's *A. labradorica*" when he compared it with a plant now known as *A. ungavensis* (Fern.) Malte, collected by Spreadborough in northern Labrador (*44442,* Can). Since Malte himself points out that the

latter plant is stoloniferous and has broad rosette leaves, Greene again stands completely vindicated.

Finally, the achenes in *A. labradorica* of Fernald and Malte are not "perfectly smooth," as Nuttall states that those of his plant are; on the contrary the mature achenes in the large number of specimens examined by the writer all show the very characteristic hairs described and illustrated by M. P. Porsild (in Rhodora **33**: 218, *fig. 4.* 1931). These hairs appear to be particularly well-developed in plants from northern Greenland and from arctic northwest Canada.

Thus, while the identity of *A. labradorica* Nutt. is still obscure, there at least can be little doubt that it is not identical with the plant described by Mrs. Ekman as *A. angustifolia.* For the latter plant the new name *A. Ekmaniana* is proposed, in recognition of Mrs. Ekman's very real contribution toward the understanding of this well-marked species. As Mrs. Ekman has already pointed out, this plant is a truly arctic species, perhaps the most arctic in the genus. In Greenland it has not been collected south of Disco Bay.

Antennaria isolepis Greene.

Great Bear Lake: North shore, *4969;* Smith Arm, *5085;* Etacho Pt., 1500′ elev., *3516;* Keith Arm, Russel Bay, *3440;* south shore, Leith Pt., *3558;* McTavish Arm, north shore, *5211;* Keewatin Distr.: Lake on Tha-anne R., *5603;* Yathkyed L., on Kazan R., *5853, 5855.*

The tomentum of the flowering stems appears to be somewhat viscid and late specimens are often covered with particles of dust and sand.

Common or occasional, particularly at some distance from the sea-coast, on sunny slopes where the snow remains late in the spring.

General Distribution: From northern Labrador to Alaska, north to Hudson Bay and Great Bear Lake.

Antennaria neoalaskana sp. nov.

Planta rhizomate brevissimo ascendente furcato subligneo instructa; innovationes sessiles, foliis spathulatis, 1–1.5 cm. longis, 0.2–0.3 cm. latis, apiculatis, utrinque leviter adpresse tomentulosis, demum glabratis; caules florigeri parcius floccosi, 5–8 cm. alti, crassi, saepe subcurvati, haud rigidi, foliis lineari-spathulatis 4–7, summis apice scariosis; corymbi laxi, juventute nutantes, plerumque tricapitulati, pedunculis brevibus crassis; involucrum foemineum circa 6 mm. altum, bracteis biserialibus, longe acuminatis, ulterioribus plus vel minus lanosis, juventute olivaceo-apiculatis, senectute pallide stramineis; pappi radii circa 4.5 mm. longi, tantum serrulati vel barbellati, nuces setis paucis distinctis munitae; stylo exserto.

The staminate plant similar, but heads smaller; involucral bracts ovate-lanceolate, obtuse, pale stramineous; pappus rays somewhat plumose-clavellate.

Richardson Mts.: Eastern slope, west of Mackenzie River Delta, 68° N., 136° W., 4000′ elev., barren gravel ridges near summit, July 7–10, 1933, *A. E. Porsild 6727* (type); same place, snow-flushes at 2500′ elev., Aug. 16, 17, 1933, *6862, 6864.*

Perhaps most closely related to *A. alaskana* Malte, which differs from it by its smaller heads and the very characteristic purplish petioles. *Antennaria neoalaskana* superficially resembles *A. subcanescens* Ostenf., but the shape of the leaves is quite distinct and they also lack the dense, pannose tomentum of that species.

Antennaria nitida Greene, Pitt. **3**: 283. 1898; Fern. in Rhodora **24**: 101. 1926; Raup in Jour. Arn. Arb. **17**: 305. 1936.

Mackenzie River: Bear Rock, 1300′ elev., *3398;* Great Bear Lake: McTavish Arm, east shore, *3739;* north shore, *3686;* south shore, *3660, 3649.*

All specimens collected were of the pistillate plant. New to the flora of the Northwest Territories.

Antennaria parvifolia Nutt. in Trans. Am. Phil. Soc. new ser. **7**: 406. 1841.

Great Bear Lake: McTavish Arm, south shore, *3641;* north shore, *5320;* east shore, *3738, 3738A.*

A remarkably uniform series from pre-Cambrian rocks of the east end of the lake is with some doubt referred to this species. Our plants have subligneous rootstocks, rather short innovations, and form small, rather dense mats. The basal leaves are short, less than 1 cm. long, spatulate, somewhat cuneate, densely adpressed-tomentose on both surfaces but not at all shiny as in *A. nitida.* The cauline leaves are well-developed, 1 to 2 cm. long, and are without scarious appendages. The heads, 3 to 5 in number, are sessile in an almost globular inflorescence, the outer bracts are lanate below, brown or stramineous, the inner ones obtuse, stiff and papery, white with a tinge of yellow. The style is barely exserted, and the achenes are glabrous and epapillose. Our plants were all pistillate.

Antennaria pulcherrima (Hook.) Greene, Pitt. **3**: 176. 1897.

Antennaria carpathica var. *pulcherrima* Hook. Fl. Bor.-Am. **1**: 329. 1834, and var. *humilis* Hook. ibid.; Malte in Rhodora **36**: 105. 1934, excl. *A. lanata;* Ostenf. in Gjöa Exp. 67. 1910.

Antennaria eucosma Fern. in Rhodora **13**: 23. 1911.

Great Bear Lake: Bear River, *3274;* south shore, Leith Pt., *3559, 3598;* north shore of Dease Arm, *4724;* north shore of McTavish Arm, *5188.*

Ostenfeld, l. c., from a fragment collected on the Arctic Coast west of the Mackenzie Delta, was the first to record this species in the Arctic. The record perhaps needs confirmation, in as much as we failed to collect this rather conspicuous species on the Arctic Coast, in the Mackenzie Delta, or in the mountains west of the Delta.

Antennaria pulcherrima appears to be restricted to calcareous soils and for this reason its distribution is not continuous, although it is now known to occur across the continent from the Gulf of St. Lawrence to Alaska, north to Hudson Bay and Great Bear Lake.

Notwithstanding Malte's remarks, l. c., *A. lanata* is really amply distinct from *A. pulcherrima* by its much reduced, conspicuously scarious-tipped cauline leaves, much lower stature, and much more lanate-tomentose leaves and stem. Also, *A. lanata* is a more southern species with a rather well-defined geographic range. In the large material now available in the National Herbarium of Canada, from mountains of Alberta and British Columbia, there is not a single sheet that in any way may be said to approach *A. pulcherrima.*

Antennaria pygmaea Fern. in Rhodora **16**: 129. 1914; ibid. **26**: 99, *tab. 142, figs. 5 & 5a.* 1924; Polunin, Bot. Can. E. Arct. 353. 1940.

Mackenzie River Delta: Richards Isl., *2286, 2287;* Great Bear Lake: Etacho Pt., 1500′ elev., *3515;* Keewatin Distr.: Yathkyed Lake on Kazan R., *5852.*

As correctly pointed out by Polunin, l. c., *A. pygmaea* is not always monocephalous and may even have two smaller heads below the central one (Pt. Burwell, *A. E. Porsild 5986*). In the writer's no. *5852* some plants have two heads of equal size side by side. In the interior of the continent *A. pygmaea* becomes much taller than in Labrador, and specimens 10–14 cm. high are not uncommon. In all specimens examined the mature achenes are glabrous, the pappus is pure white with a silky sheen, and the styles are barely exserted.

Antennaria rupicola Fern. in Rhodora **1**: 74. 1899.

GREAT BEAR LAKE: Southern part of McTavish Bay, *3648, 3640;* east shore, *3738A;* Etacho Pt., alpine meadows, 1500′ elev., *3517.*

This species, originally described from Maine, has since been collected in a number of places about the Gulf of St. Lawrence and in Newfoundland, and lately also from Lake Superior, Thunder Cape, Michigan. Abundant material of a plant first thought to be undescribed was collected in several places on Great Bear Lake. Although closely related to such western species as *A. acuminata* Greene, *A. pedicellata* Greene, or *A. Howellii* Greene, it seems, nevertheless, best placed with *A. rupicola* Fern., as do some other specimens in the National Herbarium of Canada from Yukon and from northern British Columbia.

Although Fernald, ibid. **16**: 132. 1914, reduced his species to a variety of *A. neodioica* Greene, the western plant at least is very distinct from that species. Characteristic for our plant are the strongly developed cauline leaves which are entirely without scarious tips. The achenes are dark brown and distinctly papillose.

Antennaria subcanescens Malte in Rhodora **36**: 112. 1934; Porsild in Rhodora **41**: 295. 1939.

ARCTIC COAST: Cape Dalhousie, *2800.*

Achillea sibirica Ledeb.

MACKENZIE RIVER DELTA: Portage between Campbell and Setidgi Lakes, *2028.*

Matricaria ambigua (Ledeb.) Kryl. Fl. Alt. **3**: 625. 1904. For complete synonymy see M. P. Porsild in Medd. om Grønl. **92**[1]: 72. 1932.

A common species along the Arctic Coast and thus far not collected in the interior of our district.

Chrysanthemum arcticum L.

Common along the Arctic Coast and, like the preceding, apparently a littoral species absent in the interior.

Tanacetum bipinnatum (L.) Schultz-Bip.

MACKENZIE RIVER DELTA: East Branch, *7007.*

Artemisia arctica Less.

Artemisia comata Rydb. in N. Am. Flora **34**: 263. 1916.

RICHARDSON MTS.: West of Mackenzie Delta, 1500′–2500′ elev., *6726, 6869, 6870, 7350;* ARCTIC COAST OF YUKON TERRITORY: Shingle Pt., *6911;* King Pt., *7199.*

This is perhaps the most common *Artemisia* west of the Mackenzie, on the Arctic Coast and in the mountains. It grows in moist, grassy places, on snow-flushes, and in thickets. Toward maturity the peduncles of the fruiting heads are sharply deflexed.

Hooker's record from Bear Lake, no doubt, refers to *A. hyperborea* Rydb. *Artemisia comata* Rydb. is merely the extreme arctic, depressed form of *A. arctica* Less. The specimens collected by the Canadian Arctic Expedition, including the Rydberg type from the north shore of Alaska, are all very poor, and, obviously, were collected under snow.

Artemisia biennis Willd.

MACKENZIE RIVER: Ramparts above Good Hope, *3404.*

Artemisia frigida Willd.

MACKENZIE RIVER DELTA: Campbell Lake, *2017;* East Branch, *6531;* Richards Isl., *2122;* ARCTIC COAST: Liverpool Bay, Kugaruk, W. of Anderson R., *3089.*

On sandy slopes on the East Branch of the Mackenzie Delta *A. frigida* is one of the dominant species. When fresh, the plant is strongly aromatic and, during the hot weather, colonies of *A. frigida* along the East Branch can be detected by their fragrance at a distance of several miles.

Artemisia hyperborea Rydb. in N. Am. Flora **34**: 262. 1916.

MACKENZIE RIVER DELTA: East Branch, *7052, 7278;* GREAT BEAR LAKE: Smith Arm, north shore, *5018;* Cape McDonnel, *5164.*

This species, like *A. frigida,* when fresh, is strongly aromatic. It grows in dry sandy or gravelly places.

Artemisia Richardsoniana Bess. in Bull. Soc. Nat. Mosc. **9**: 64. 1836. See Rydb. in N. Am. Flora **34**: 261. 1916.

ARCTIC COAST: Cape Dalhousie, *2807.* Our specimens are larger but otherwise match what is probably a duplicate of the type, labelled by Hooker "A. arctica—*Dr. Richardson*" (Can).

This rare plant, which has been collected but a few times on the Arctic Coast, differs strikingly from *A. hyperborea* in its dense investment of white wool 0.5 cm. long. The flowering stems are reddish and the inflorescence compact. Rydberg's record, l. c., from "Northern Alberta" probably needs confirmation.

Artemisia spithamaea Pursh.

GREAT BEAR LAKE: McTavish Bay, *3685.*

Petasites arcticus sp. nov.

Herba perennis, rhizomate crasso horizontali instructa; folia cum floribus contemporanea, palmatim venosa, lobata, reniformia, evoluta 15–30 cm. lata, 10–15 cm. longa, marginibus molliter ciliata caeterum et tenella utrinque glabra, laete pallide viridia, lamina vix ultra medium in lobis 5–8 cuneatis mucronato-dentatis partita, petiolis obscure purpurascentibus quam lamina circa duplo longioribus; caulis 50–70 cm. longus, parcius floccoso-tomentosus, bracteis scariosis paucis instructus; inflorescentia corymbosa, pedunculis fructigeris 5–10 cm. longis; involucrum plantae foemineae 1 cm. longum, bracteis basi tomento tenui brunneo indutis; stigma bilobum, nuculae lineares, glabrae; pappus sericeus albido-flavus.

MACKENZIE RIVER DELTA: East Branch, 68° 40′ N., in wet clay of shady ravines, with almost mature fruit on June 26, 1932, *A. E. Porsild 6515* (TYPE). Additional collections are: RICHARDSON MTS.: West of Delta, shaly scree, 1500′ elev., *7349;* MACKENZIE RIVER DELTA: East Branch, *6952;* ARCTIC COAST OF YUKON TERRITORY: Between King & Kay Pts., *7208;* ESKIMO LAKE BASIN: Kugaruk, west of Anderson R., *3058.*

Petasites arcticus is a common species on wet, shaly, or clayey slopes, where it flowers and fruits very early in the season. It is perhaps most closely related to *P. speciosus* (Nutt.) Piper, from which it differs in its perfectly glabrous leaves, which also lack the flat bristles on the upper surface of the leaf so characteristic of that species.

Petasites frigidus (L.) Fries, Macoun & Holm, Rept. Can. Arct. Exp. **5A**: 22. 1921. To the synonymy given by Rydb., in N. Am. Flora **34**: 312. 1927, should be added:

Petasites gracilis Britt. in Bull. N. Y. Bot. Gard. **2**: 186. 1901.

Petasites frigida (L.) Fries var. *corymbosa* (R. Br.) Herder, Pl. Radd. Monopet. 3^2: 4. 1867.

Nardosmia sagittata sensu Hook. Fl. Bor.-Am. **1**: 307. 1834, non Pursh, at least in part.

ARCTIC COAST OF YUKON TERRITORY: Shingle Pt., *7115;* RICHARDSON MTS.: *6629;* MACKENZIE RIVER DELTA: East Branch, *6961;* Campbell Lake, *1971;* Richards Isl., *2284, 2285;* Kittigazuit Isl., *2405;* ARCTIC COAST: Atkinson Pt., *2669;* Liverpool Bay, *2937;* GREAT BEAR LAKE: Ft. Franklin, *3225;* north shore, Haldane R., *4947.*

A western arctic-alpine species in America, common from the Bering Sea region north and east along the Arctic Coast to Coronation Gulf and the western Arctic Archipelago to Melville Island, south to Great Bear Lake and in high mountains of Alaska, Yukon, Alberta, and British Columbia south to lat. 54°.

Petasites hyperboreus Rydb. in N. Am. Flora **34**: 312. 1927.

This apparently is an alpine plant endemic to mountains of Alberta, British Columbia, and possibly Washington. The writer strongly suspects that this species is identical with *P. nivalis* Greene, Pitt. 2: 18. 1889. Rydberg is certainly wrong when, l. c., he gives *Nardosmia corymbosa* Hook., Fl. Bor.-Am. 1: 307. 1834, as a synonym, even though he qualifies the statement by adding "mainly." Although Hooker, l. c., obviously misunderstood that genus, there can be no doubt that by *N. corymbosa* he referred to the arctic plant. Thus, from the distribution given by Rydberg, l. c., from *P. hyperboreus* should be excluded: "Arctic Coast from Hudson Bay to Alaska."

Petasites sagittatus (Banks) Gray. To the synonymy given by Rydb., in N. Am. Flora **34**: 311. 1927, should be added:

Nardosmia frigida sensu Hook. Fl. Bor.-Am. **1**: 307. 1834, non L., at least in part.

Mackenzie River Delta: East Branch, *7297;* Aklavik, *7314;* Great Bear Lake: Dease Arm, north shore, *4904;* Mackenzie Distr.: Thelon R., lat. 63°–64° N., *Tyrrell 23184, 14691* (Can); Thelon R., mouth of Hanbury R., *Radford 132367* (Can).

It seems abundantly clear that Hooker, l. c., either misunderstood the genus or else his notes somehow had become mixed. Thus *Nardosmia frigida* is described: "foliis cordatis inaequaliter dentatis subtus tomentosis," but in the discussion he states: "From Lake Winnipeg, in lat. 52°, to Ft. Franklin, in lat. 66°, *Dr. Richardson*—Very few of the specimens gathered have leaves exactly answering to the above character, and of these, some are nearly ten inches long, independent of the petiole." This clearly shows that Hooker, at least in this instance, spoke of *P. sagittatus,* which is the largest-leaved and least northern of the non-palmately veined species of *Petasites.* This is amply born out by a photograph in the Gray Herbarium, made by Professor M. L. Fernald in 1903 from Hooker's Herbarium in the British Museum, showing a sheet of typical *P. sagittatus.* It is labelled: "*Nardosmia frigida* Hook. L. Winnipeg R." Another photograph shows a sheet which is labelled at the bottom: "*Nardosmia sagittata,* Hook. Fl. Bor.-Am. 307 in part, not *T. sagittata* Pursh." On the sheet are two collections, both labelled *Nardosmia sagittata* Hook. The first is from "Cape Bathurst on the Arctic Coast," the second is labelled "Between Y. H. & Cd. H. Spa. 1825, R." Both collections show plants of typical *P. frigidus* in various stages of leaf-denticulation. Finally, a third photograph shows a small specimen of *P. sagittatus.* It was originally labelled: "Tussilago palmata, Okak in Labrador leg. Weitz"; an additional notation on the back of the sheet reads: "America Septentrionalis, Labrador, 1785, Soc. unit. fratr." The label bears a subsequent correction which reads: "T. frigida."

Petasites sagittatus is apparently an eastern species distributed from Labrador west to the Mackenzie and Yukon Territory.

Arnica alpina (L.) Olin ssp. **angustifolia** (J. Vahl) Maguire in Madroño **6**: 153. 1942.

For his monograph of the genus, Dr. Bassett Maguire has kindly named the Arnicas in the writer's collection. While the writer would prefer to assign specific rank to ssps. *attenuata* and *tomentosa,* he is following Dr. Maguire's interpretation.

Richardson Mts.: West of Mackenzie Delta, 1500′ to 2500′ or occasionally 4000′ elev., *6865;* Mackenzie River Delta: East Branch, *6516;* Campbell Lake, *1972, 1973;* Richards Isl., *2280;* Arctic Coast: 6 mi. east of Kittigazuit, *2529, 2530;* Tuktuayaktoq, *7447* (the last four numbers, according to Maguire, approach ssp. *attenuata*); Liverpool Bay, *2947;* Great Bear Lake: Dease Arm, Narakay Isl., *4856;* Bear River, *3248* (last two approaching ssp. *attenuata*); Etacho Pt., 1500′ elev., *3518;* Dease Arm, Dease Valley, *4882* (approaching ssp. *Sornborgeri*); Dease Arm, north shore, *4728.*

A widely distributed arctic subspecies, common in North America on sandy and gravelly slopes, from Greenland west at least to the Mackenzie, south to the limit of trees.

Arnica alpina (L.) Olin ssp. **attenuata** (Greene) Maguire in Madroño **6:** 153. 1942.

Richardson Mts.: West of Mackenzie Delta, in thickets on the lower slopes, *7348* (approaching ssp. *angustifolia*); Mackenzie River Delta: East Branch, *7004;* Keewatin Distr.: Lake on Tha-anne River, *5602* (approaching ssp. *Sornborgeri*).

A western subspecies, perhaps less common and decidedly more southern in its distribution than ssp. *angustifolia.*

Arnica alpina (L.) Olin ssp. **tomentosa** (J. M. Macoun) Maguire in Madroño **6:** 153. 1942.

Richardson Mts.: West of Mackenzie Delta, alpine slopes, 4000′ elev., *6728* (× *A. louiseana* ssp. *frigida*); Arctic Coast: Atkinson Pt., *2670;* Great Bear Lake: Cape McDonnel, *5162A.*

New to the flora of the Northwest Territories.

Arnica Lessingii Greene, Pitt. **4:** 167. 1900.

Richardson Mts.: West of Mackenzie Delta, alpine slopes between 1500′ and 2500′ elev., *6866.*

New to the flora of the Northwest Territories.

Arnica louiseana Farr. ssp. **frigida** (Meyer) Maguire in Madroño **6:** 153. 1942.

Richardson Mts.: West of Mackenzie Delta, grassy slopes, 1500′ elev., *6867;* Mackenzie River Delta: Richards Isl., *7080;* East Branch, *6968;* Great Bear Lake: Cape McDonnel, *5162.*

New to the flora of the Northwest Territories.

Senecio atropurpureus (Ledeb.) Fedtsch. See Porsild in Rhodora **41:** 298. 1939.

Richardson Mts.: West of Mackenzie Delta, alpine slopes betweeen 1500′ and 3000′ elev., *6724, 6725, 6875, 6876;* Arctic Coast of Yukon Territory: Between King and Kay Pts., *7165, 7166, 7203, 7205.*

The specimens in the above series are somewhat variable; thus on barren hill tops and in gravelly places the entire plant becomes tomentose, with reduced stem leaves and few heads, while in moist grassy places it is glabrate or sparingly arachnoid with from 2 to 5 heads. In life the rays are dark croceous, but in drying they fade and become much paler. The mature achenes are sparingly strigose-hirsute.

A western species in America. Near the Arctic Coast it reaches the west bank of the Mackenzie.

Senecio hyperborealis Greenm. in Ann. Mo. Bot. Gard. **3:** 98. 1916.

Mackenzie River Delta: Campbell Lake, *1967–1969;* East Branch, *6518, 7055;* Arctic Coast: Liverpool Bay, *2941, 2942;* Great Bear Lake: Bear R., Mt. Charles, *3305.*

This pretty little *Senecio* grows on calcareous rocks and flowers from the middle of June throughout the summer. It appears to be an endemic of the Yukon Territory and northwestern Mackenzie.

Senecio Kjellmanii A. E. Porsild. See Rhodora **41:** 299. 1939.

Richardson Mts.: West of Mackenzie Delta, 3000′ elev., *6722.*

Senecio pauperculus Michx.

Great Bear Lake: South shore, Leith Pt., *3557, 3597.*

Senecio resedifolius Less.

Richardson Mts.: West of Mackenzie Delta, 3000′ elev., *6723.*

Saussurea angustifolia DC.

Richardson Mts.: West of Mackenzie Delta, *6877;* Mackenzie River Delta: East Branch, *6554, 6715;* Richards Isl., *2131, 2293, 7452;* Kittigazuit Isl., *2406;* Eskimo Lake Basin: *3016;* Setidgi Lake, *3171, 3172;* Great Bear Lake: Dease Arm, Dease Valley, *4881;* Keewatin Distr.: Yathkyed L., on Kazan R., *5859.*

The above series shows a great deal of variation from glabrous to lanulose and from narrow, entire to lanceolate, repand-dentate leaves. Some are low with a few heads in open, long-pedunculate corymbs, others are from 8 to 50 cm. high. Since they are all alike in floral characters, the writer thinks it inadvisable to separate the material on vegetative characters alone.

A western arctic species, in America reaching east to central Keewatin.

Taraxacum

The large series of *Taraxacum* collected in Alaska in 1926 and in the Mackenzie District in 1927–1928 were sent to the late Dr. Dahlstedt in 1930, but upon his death they were returned unnamed. In 1936, the collection, with additional material collected in the Keewatin District in 1930 and in the Mackenzie in 1932–1935, was sent to Dr. Haglund. When returned two years ago, annotations showed that in the collection Dr. Haglund had detected 5 or 6 undescribed species. As far as the writer is aware, none of them has yet been published.

Taraxacum alaskanum Rydb.

Richardson Mts.: West of Mackenzie Delta, 1000′–4000′ elev., *6878, 7347;* Mackenzie River Delta: East Branch, *6557;* Richards Isl., *2295.*

A very pretty little species, apparently endemic to Alaska and Yukon, and reaching east to the Mackenzie or slightly beyond.

Taraxacum Carthamopsis M. P. Porsild in Trans. Roy. Soc. Can. 3 ser. 33: *29, tab. 1–3.* 1939.

Mackenzie River Delta: East Branch, sandy river banks, *7279.*

Thus far known only from the type locality.

Taraxacum lacerum Greene.

Great Bear Lake: Dease Arm, Narakay Isl., *4857;* McTavish Arm, north shore, *5322.*

Taraxacum phymatocarpum Dahlst.

Arctic Coast: Cape Dalhousie, *2812;* Liverpool Bay, *2951.*

Rare or occasional on the Arctic Coast and Islands.

Agoseris ? cuspidata (Pursh) Steud.

Mackenzie River Delta: East Branch, between 68° 30′ and 68° 55′ N., *6741, 6885, 6896, 7051.*

Our plant has narrow, linear-lanceolate leaves, 0.8 cm. wide and 20–25 cm. long, shorter than the scape, pubescent and conspicuously ciliate, purple at the base; scape lanulose below the head; bracts broad, cuspidate with dark purplish center, densely and coarsely lanulose. The ligules are yellow, fading toward the tip. Achenes cylindrical, beakless, prominently ribbed. Our plant flowered in the last week of July and produced abundant fruit. It is rare or occasional on sandy slopes along the East Branch and was seen nowhere else.

Crepis elegans Hook.

GREAT BEAR LAKE: Bear R., *3249, 3373.*

Crepis nana Richards.

RICHARDSON MTS.: West of Mackenzie Delta, *6627.*

Hieracium gracile Hook.

GREAT BEAR LAKE: Etacho Pt., 1500′ elev., *3524.*

New to the flora of the Northwest Territories.

Hieracium canadense Michx.

GREAT BEAR LAKE: Bear R., Mt. Charles, *3345;* McTavish Arm, *3658.*

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THE WILLOWS OF THE HUDSON BAY REGION AND THE LABRADOR PENINSULA

HUGH M. RAUP

with four plates

INTRODUCTION

THE following paper, on the willows of the Hudson Bay region and the Labrador Peninsula, has grown out of efforts to determine collections from that area. In the summer of 1939 Dr. and Mrs. Ernst C. Abbe and Mr. John Marr, of the University of Minnesota, made a journey to Richmond Gulf on the eastern coast of Hudson Bay for the purpose of making general botanical collections.[1] Later, in working up his material, Dr. Abbe obtained a quantity of undetermined or partially determined material from the Hudson Bay region collected by others over a period of many years. Most of this came from the Herbarium of the Carnegie Museum of Pittsburgh and was collected by various people who have gone to Labrador and Hudson Bay from that museum on ornithological and mammalogical collecting expeditions. Most of the botanical specimens were gathered by Mr. W. E. Clyde Todd, Dr. George M. Sutton,[2] and by Mr. and Mrs. J. K. Doutt.[3] In addition to the Carnegie Museum material Dr. Abbe also obtained some Labrador collections from the University of Minnesota, mostly collected by Margaret E. Oldenburg, who made a trip around the Labrador coast in 1939.

The willows from these assembled collections, totalling 284 numbers, were turned over to me for determination. With the exception of one collection from Southampton Island, scarcely any records for them have previously appeared in the literature, and they constitute most of the new material on geographic distribution to be found in the present paper. The exception mentioned above is that of the collection of Dr. George M. Sutton in 1929–30, of which I published a list in 1936.[4] This collection was restudied later by Dr. Nicholas Polunin and cited in his "Botany of the Canadian Eastern Arctic."[5]

In working up this material and preparing the list I have had access to the collections of the Gray Herbarium, the Arnold Arboretum, and the National Herbarium of Canada. I have also seen much of the pertinent material at the herbarium of the New York Botanical Garden, particularly of those species which are of critical nature. In all I have seen about 1300 collection numbers, involving approximately 1700 specimens.

[1] Abbe, E. C. The expedition to Hudson Bay of the University of Minnesota. Science **90**: 458–459 (1939).

[2] See Mem. Carn. Mus. **12**.

[3] See Todd, W. E. C. More about Labrador. An account of a trip to the Grand Falls of the Hamilton River. Carnegie Mag. **13**: Sept. (1939). Also, Ann. Rept. Carn. Mus. Pittsburgh **1938**: 14–15 (1939).

[4] Raup, H. M. Pteridophyta and Spermatophyta of Southampton Island. Mem. Carn. Mus. **12**[3]: 17–30 (1936).

[5] Polunin, Nicholas. Botany of the Canadian Eastern Arctic, I. Pteridophyta and Spermatophyta. Nat. Mus. Can. Bull. **92**: Salix, 151–173 (1940). See also Polunin, N. Flora of Southampton Island, Hudson Bay. Jour. Bot. **76**: 93–103 (1938).

The area involved covers the shores of Hudson and James Bays and the Labrador Peninsula. Westward in the District of Keewatin it includes the basins of the Kazan River and Baker Lake and the basin of the Dubawnt River up as far as Dubawnt Lake. In northern Manitoba and Ontario it extends westward approximately to long. 96° W. and southward to about lat. 51°. In the north it includes Southampton Island and smaller islands of the northern part of Hudson Bay, as well as the islands in Hudson Strait (in the District of Franklin). Southeastward I have included all of the Labrador coast south to the Straits of Belle Isle, and the north shore of the Gulf of St. Lawrence westward to Seven Islands. The islands off the north shore of the Gulf, including Anticosti, have also been covered, as well as that part of Newfoundland which adjoins the Straits of Belle Isle.

It will be noted that this area adjoins or overlaps the areas of the following comprehensive lists recently published: at the north, Polunin's "Botany of the Canadian Eastern Arctic"; at the southwest, Rydberg's "Flora of the Prairies and Plains";[6] and at the southeast, Marie-Victorin's "Flore Laurentienne."[7] Polunin's area extends south to lat. 60° and west to long. 95°, thus forming the largest overlap with the present paper. All of the willows listed by Polunin for the eastern Arctic, except for a minor form described from southern Baffin, are to be found in the area treated here. Rydberg's Flora reaches northward, technically, only to southern Manitoba in this longitude, but so many of the willows listed in it are of wide range in the Canadian forests that it serves very well for much of the country in the whole basin of Lake Winnipeg. Victorin's flora covers southern Quebec northeastward only to Lake St. John and the Saguenay River. Eastern Keewatin will be more thoroughly treated when A. E. Porsild's studies of the western arctic Canadian flora are published and his specimens distributed. This work is now in progress.

The present paper contains very little in the way of taxonomic innovation, and no new species, varieties or forms. In general organization it rests very largely upon the monographic studies of American willows made by Dr. Camillo Schneider. Its main reason for being is that it records for the first time in one place a large mass of new fact about the willows of this region. The immediate results have been the clarification of some of the more poorly known species and a greatly increased knowledge of the geographic aspects of the genus as a whole in northeastern America. It is hoped that these results, together with the diagnostic keys, will facilitate further collection and study of the group. The accumulation of large amounts of new specimen material, however, is not an unmixed advantage; for while some of the lesser-known entities are clarified, many of the "well-known" ones begin to fray at the edges and to show distressingly close relationships with other "well-known" species. This seems to be particularly the case with the genus *Salix*, although whether it is due, as some students appear to think, to promiscuous hybridity, or to some other form of cytological perversity, is yet to be fathomed.

I shall make no attempt to give a complete history of willow-collecting in the region covered. In the middle of the last century the great Swedish monographer, N. J. Andersson, had only a few scattered specimens from the southern Labrador coast and a few from the arctic and Hudson Bay coasts. The first

[6] Rydberg, P. A. Flora of the prairies and plains of central North America. Publ. by the N. Y. Bot. Gard. (1932).

[7] Victorin, Fr. Marie-. Flore Laurentienne. Montreal (1935).

modern collections of consequence were those of the Canadian botanists and geologists John Macoun, James M. Macoun, William Spreadborough, Robert Bell, and A. P. Low. The knowledge of eastern arctic and subarctic willows accumulated by M. S. Bebb in the 1880's and '90's, and by Rydberg in 1899, rested largely upon these Canadian collections. They were of necessity scattered and incomplete. Spreadborough and J. M. Macoun made trips with geological survey parties to James Bay and the southwestern coasts of Hudson Bay, partly by boat, partly overland to the southern tip of James Bay and northeastward from Lake Winnipeg. James M. Macoun did not make his collecting trip along the northwest coasts of Hudson Bay until later, in 1910.[8] The coasts of the Labrador Peninsula were surveyed by Bell and Low and their associates in the 1880's and 1890's, for the Canadian Geological Survey. Both these men were remarkably well-trained naturalists, and I have seen nearly 50 numbers of willows collected by them alone. On Low's trip from Richmond Gulf to Ungava Bay in 1896 he took along Spreadborough, who made substantial botanical collections from a vast inland region not since visited by a botanist.

Dr. Camillo Schneider, a German student of willows, came to America in 1917 and was interned at Boston for the duration of the first World War. He was quartered at the Arnold Arboretum and undertook monographic studies of American *Salix*, which he finally finished in 1921, after his return to Germany. While at the Arboretum he borrowed large quantities of material from the principal herbaria of America, making careful dissections and sketches of hundreds of specimens. At the same time, although greatly handicapped due to the inaccessibility of types, he made remarkable progress toward the solution of many problems of nomenclature. Schneider brought to bear, in these studies, an extraordinary knowledge of the genus as a whole. Just before beginning the American work he had finished a synopsis of the genus in eastern Asia and the Himalayas for "Plantae Wilsonianae."[9] In America he was able to see representative material from nearly all parts of the continent from which specimens were then available. His delineation of American species, although far from ideal in many instances, is in the main realistic and workable; and his comprehensive keys are the best that have been published to date. Unfortunately, his results were printed serially[10] in such a way that they have reached relatively few students, and under a reprint policy that has made it almost impossible to gather the whole series into a single book. The first few volumes of the Journal of the Arnold Arboretum have long since been out of print, so that Schneider's keys, index, and much of his discussion are entirely unobtainable. Furthermore, the keys are all in Latin, of which translations have never been published, so that students and collectors who do not use Latin readily are handicapped at the outset.

With regard to our region, however, Schneider was not much better supplied with material in 1918 than were Bebb and Rydberg in the '90's. Of the 1300

[8] Macoun, J. M. Flora and fauna of the west coast of Hudson Bay. Geol. Surv. Can. Summ. Rept. **1910**: 281–283 (1911).

[9] Schneider, C. Salicaceae, in Sargent, Plantae Wilsonianae **3**: 16–179 (1916), Publ. Arn. Arb. 4.

[10] Schneider, C. A conspectus of Mexican, West Indian, Central and South American species and varieties of Salix. Bot. Gaz. **65**: 1–41 (1918); Notes on American willows, I. Bot. Gaz. **66**: 117–142 (1918), II. ibid., **66**: 318–353 (1918), III. ibid., **67**: 27–64 (1919), IV. ibid., **67**: 309–346 (1919), V. Jour. Arn. Arb. **1**: 1–32 (1919), VI. ibid., **1**: 67–97 (1919), VII. ibid., **1**: 147–171 (1920), VIII. ibid., **1**: 211–232 (1920), IX. ibid., **2**: 1–25 (1920), X. ibid., **2**: 65–90 (1920), XI. ibid., **2**: 185–204 (1921), XII. ibid., **3**: 61–125 (1921).

numbers that I have seen, only 234 were available to Schneider in 1917–18, and probably not more than 50 of these were new after Rydberg's study in 1899. In short, during the past 25 years, since Schneider's monographic work, the willow collections from our region have been increased more than five-fold. To the greater numbers of specimens, moreover, must be added the fact that far more highly trained and experienced collectors have visited the region in these recent years than in all the preceding period. To mention only a few, there were M. O. Malte, E. C. Abbe, R. H. Woodworth, M. L. Fernald (Nfld.), Nicholas Polunin, Victorin & Rolland, H. F. Lewis, and Harold St. John. During the past 25 years, also, several new species and varieties have been described, chiefly by Professor Fernald, who has done much to straighten out some of the worst taxonomic tangles with which we have to deal. It has been necessary to re-examine these recently described plants and insert references to them in the keys.

Neither in the arrangement of the list nor in the keys have I indicated sectional subdivisions of the genus. With our present understanding of relationship, present and past, among the species, it is somewhat hazardous to do so. True, some of the species fall readily and reasonably into groups that can be regarded as sections, but intermediates can be recognized between so many of these supposedly well-established sections that their boundaries in many cases cease to be useful. Furthermore, the continued description of new forms not only increases the number of these intermediates, but also continues to bring out species that will not go into any of the known sections.

For what it may be worth, the following is a tentative disposition of the species of our region in the recognized sections of the genus.

Pentandrae: *serissima, lucida.*
Longifoliae: *interior.*
Reticulatae: *reticulata, vestita, jejuna.*
Herbaceae: *Uva-ursi, herbacea.*
Ovalifoliae: *arctica, arctophila, hudsonensis.*
Glaucae: *glauca, cordifolia, brachycarpa, fullertonensis.*
Cordatae: *cordata, lutea, myrtillifolia, glaucophylloides, adenophylla.*
Balsamiferae: *pyrifolia.*
Chrysantheae: *Richardsonii, calcicola, Wiegandii, alaxensis, laurentiana.*
Candidae: *candida, cryptodonta.*
Fulvae: *Bebbiana.*
Roseae: *pedicellaris, simulans.*
Griseae: *humilis.*
Discolores: *discolor.*
Phylicifoliae: *planifolia, paraleuca, pedunculata, amoena, pellita.*
Sect. Incertae: *arbusculoides, argyrocarpa.*

Some of the uncertainties of this arrangement are shown by *S. simulans,* which combines the leaves of the *Roseae* with the pistillate aments of the *Glaucae;* by *S. jejuna,* which has characters of both the *Reticulatae* and the *Ovalifoliae;* by *S. amoena,* which has a general resemblance to the *Phylicifoliae,* but with floral bracts like those of the *Glaucae.* As pointed out by Schneider, *S. arbusculoides* and *S. argyrocarpa* are more or less unique and do not fit into any known sections.

The maps [11] are based principally upon specimens cited in this paper, although in some cases published records have been used if they could be reasonably well authenticated. Very few such records have been used for the more variable and

[11] The base map used is by J. Paul Goode, published by the University of Chicago Press.

controversial species groups. I have tried to make the maps as complete as possible for the whole area of each. For regions outside that treated in the present paper I have used, in addition to specimens at the Harvard herbaria, chiefly Polunin's "Botany of the Canadian Eastern Arctic," Grøntved's paper on collections from the 5th Thule Expedition,[12] and papers by M. P. Porsild [13] and T. W. Böcher [14] on the Greenland flora.

A detailed discussion of problems in the geographic distribution of northeastern American willows is beyond the scope of the present paper. Nevertheless, a number of outstanding geographic facts are evident even from a cursory examination of the maps, and may be stated briefly.

Sixteen of the species listed are distinctly southern in their distribution within our region, reaching northward only to the north shore of the Gulf of St. Lawrence or at most to the southern parts of James and Hudson Bays or the Hamilton River district. Some of these are of wide western range in the Canadian forest: *interior, brachycarpa* and var. *antimima, pyrifolia, myrtillifolia, pedicellaris* var. *hypoglauca, Bebbiana, candida.* Others are eastern in the Canadian forest or range far southward in the Alleghanian region: *serissima, lucida, cordata, glaucophylloides, adenophylla, humilis, discolor, pellita. Salix lutea* probably should be in this category, although it apparently comes into our region from the northern Great Plains, where it has a large development. Some of the more distinctly eastern forms have close relatives, or vicariads, in western America. The eastern *serissima* and *lucida* are replaced in the west by *lasiandra; cordata* by *mackenziana, pseudocordata,* and their relatives; *discolor* by *Scouleriana; pellita* by *subcoerulea; Bebbiana* by *Geyeriana.*

At the other extreme, in the north, is a group of arctic species, some of which come south only to the Straits of Belle Isle or Newfoundland while others, such as *herbacea* and *Uva-ursi,* reach the mountains of New England. Only one of these is of wide range in arctic America: *reticulata;* the others are prevailingly eastern: *arctophila, arctica* vars. *Brownei* and *kophophylla, herbacea, Uva-ursi, argyrocarpa, vestita* (typical), *cordifolia* and vars., *calcicola.* As in the case of the southern species, some of these have western counterparts, *arctiça* vars. *Brownei* and *kophophylla* being replaced in the west by other forms of *arctica,* typical *vestita* by its var. *erecta, cordifolia* by *glauca* and its variations, and *calcicola* by *Richardsonii.* Some of the western vicariads reach eastward to Hudson Bay and overlap their eastern relatives in that region, i.e., *glauca, Richardsonii,* and *vestita* var. *erecta.* Another willow which is widespread in the eastern arctic is *S. planifolia,* which, however, extends far west in the northern Canadian forest to the Rocky and Mackenzie Mountains. It is finally replaced in Mackenzie, Yukon, and Alaska by *S. pulchra,* and farther south in the mountains by its var. *monica.*

In the northwestern and western parts of our area there appears a peculiar group of species, some of which seem to be endemic in central arctic America while others are of far western affinity. Of the latter, *Richardsonii* and *glauca* have already been mentioned, while *arbusculoides* and *alaxensis* var. *obovalifolia*

[12] Grøntved, Johs. Vascular plants from arctic North America collected by the Fifth Thule Expedition, 1921–24. Rept. 5th Thule Exped. **2**: 32–35, Copenhagen (1936).

[13] Porsild, M. P. Stray contributions to the flora of Greenland. VI–XII. Meddel. Grønl. **93**[3]: 60 (1935).

[14] Böcher, T. W. Biological distributional types in the flora of Greenland. Meddel. Grønl. **106**[2]: 1–339 (1938).

should be added. None of these have ever been collected on the Labrador coast or the north shore of the Gulf of St. Lawrence, although *Richardsonii* and *glauca* var. *acutifolia* have been found in southern Baffin, and the latter on the shores of Hudson Strait. Apparently endemic to this region and the central arctic coast are *fullertonensis, hudsonensis, calcicola* var. *Nicholsiana,* and *glauca* var. *stenolepis.* It may be that *alaxensis* var. *obovalifolia* should be in this small group of endemics. Ball, who described the variety, believes that it is peculiar to the country east of the northern Cordillera. It should be noted that all of the endemic group are rather poorly known and need more study before their taxonomic and geographic affinities can be properly worked out.

There remains to be mentioned a group of apparent endemics and isolated populations that center about the Gulf of St. Lawrence.[15] The endemics include *jejuna, Wiegandii, laurentiana, cryptodonta, simulans, paraleuca, pedunculata, amoena, vestita* var. *psilophylla, cordifolia* var. *eucycla, myrtillifolia* var. *brachypoda, pellita* f. *psila.* The presence of typical *S. brachycarpa* in Gaspé, Anticosti, and on Hudson Bay is a striking example of a Rocky Mountain species with isolated populations in the east.

It is of interest to consider, together, the group of arctic and subarctic species which are distinctly northeastern in America. In addition to the 12 endemics of the Gulf of St. Lawrence just noted, there are *Uva-ursi, argyrocarpa,* and *cordifolia* that have not been authentically recorded west of the east coast of Hudson Bay. Another small group has been collected on the west coast but not much farther west: *arctica* vars. *Brownei* and *kophophylla, herbacea, vestita* (typical), *calcicola.* To the above must be added the two endemics of the northern part of Hudson Bay and southern Baffin, *calcicola* var. *Nicholsiana* and *glauca* var. *stenolepis. Salix fullertonensis* and *hudsonensis* may have to be included here, but until their western ranges are better known they can hardly be considered with the eastern group.

One can hardly avoid an immediate division of these 22 eastern forms into two categories by the size of their areas. The endemics of the St. Lawrence and the Hudson Strait region are all highly localized, with areas relatively very small. All of the other species noted, on the other hand, are of wide range or are nearly ubiquitous. Another fact of interest is that the relationships of the Gulf of St. Lawrence endemics are not with the group of species that has a wide southern range in the Alleghanian region, but rather with arctic and Canadian forest species. *Salix jejuna* has its nearest relations with *reticulata; Wiegandii* and *laurentiana* probably belong in the section *Chrysantheae,* which contains *alaxensis, Richardsonii* and *calcicola; cryptodonta* was placed provisionally in the *Candidae* by Schneider; *paraleuca, pedunculata, amoena,* and *pellita* apparently belong in the *Phylicifoliae* with *planifolia, pulchra,* etc.

The keys are largely modifications of those already in use. The main key to the species follows Schneider's,[16] with the insertion of forms that have been described since he prepared it. Rather than confuse the main key with varietal subdivisions, I have placed keys to varieties and forms under the separate species. Some of these minor keys are newly constructed or modified from existing ones, while others, such as that for the varieties of *S. cordifolia,* I have copied verbatim from their sources.

[15] See Fernald, M. L. Persistence of plants in unglaciated areas of boreal America. (Mem. Gray Herb. 2); Mem. Amer. Acad. 15[3] (1925).

[16] Schneider, C. Jour. Arn. Arb. 3: 97–106 (1921).

A key involving staminate flowers would be extremely desirable, but it could be only partially practicable with our present knowledge of the willows of this region. This is due, first, to inherent difficulties in the construction of such a key, for the degree of variability among the characters of the staminate flowers is not nearly so well-known as among those of the pistillate. Even with a relatively large amount of material before him, Schneider had only indifferent success with his key to staminate plants and found it nearly impossible to determine, by means of staminate material, many of the species in such a widespread and variable group as that related to *S. glauca*. A second major difficulty arises from the fact that, to the best of my knowledge, fully one-fourth of the species treated in this paper are known only by their pistillate plants: *cryptodonta, laurentiana, paraleuca, pedunculata, amoena, pellita, simulans, jejuna, hudsonensis, fullertonensis*. True, most of these are among the rarer species, but *S. pellita* is widespread and well-represented in the herbaria. Some of the species flower very early in the season, so that the ephemeral staminate blossoms are gone before the dates when collectors usually reach the field.

Any workable key to the willows perhaps needs some defense. An ideal diagnostic key to an ideal genus uses clear-cut unit characters that immediately separate the species. However, so many species of willows are based upon elaborate combinations of characters that such an ideal situation is scarcely ever realized. Schneider fully appreciated this and constructed a key that is to a great extent descriptive; consequently it does not depend so heavily upon individual characters. Those who have not used it extensively, or who have not had to deal with large series of specimens, are apt to be impatient with its length and complexity, not to mention the extraordinary amount of apparent equivocation that occurs in it. In a sense, these words and expressions of equivocation are an index to the practicality of the key, because they allow for a large amount of character variability while the composite pattern of the species is being outlined.

I have made no effort to present the complete synonymy of each species. Following the name are cited the place of original description of the species, variety or form, and then the papers in which this name has been used in describing the flora of our region. These papers are cited in chronological order. Likewise, such synonyms as I have mentioned are those that have been used in floras of the region. For more complete synonymy the student is referred particularly to the cited papers by Schneider, and to those by Dr. Carleton R. Ball for the sections *Cordatae, Longifoliae,* and *Pentandrae*.

In the citation of specimens, I have followed a geographic sequence beginning in the northern part of Hudson Bay with Southampton Island. Then come the western coasts of Hudson and James Bays southward to the tip of the latter, and then the eastern coasts northward. These are followed by records from the south side of Hudson Strait, Ungava Bay, and the coast of Labrador southward to the Straits of Belle Isle. The sequence then proceeds westward along the north shore of the Gulf of St. Lawrence to Seven Islands, after which come the Mingan Archipelago and Anticosti. Specimens from inland regions along this course, or islands off the coasts, are usually cited in their appropriate places; thus plants from inland Keewatin are cited opposite those from the coast in that region, and those from the Hamilton River country are usually cited opposite those from Hamilton Inlet and vicinity. Plants from northern Newfoundland are grouped with those on the Labrador side of the Straits of Belle Isle. I have

also inserted the names of territories and provinces, dividing the Quebec localities rather arbitrarily into "Northern"—those on James and Hudson Bays and Hudson Strait, and "Southern"—those on the north shore of the Gulf of St. Lawrence. In the case of islands, their correlation with political boundaries may not be infallible, for I have preferred to cite the specimens from these islands along with that part of the coast which they are nearest. I have been able to locate on maps nearly all of the localities from which I have seen specimens, but there are still several (less than half a dozen) that I have not found. These are cited only approximately in their proper places in the geographic sequence.

In each citation the name of the locality is given in roman type, and the name of the collector, with the number or numbers, in italics. If no number is available, dates have been used. The herbaria from which I have seen the specimens are indicated by symbols in parentheses. If more than one number of the same plant, locality, and collector were seen, these symbols appear only after the last number. A key to the symbols is as follows: A—Arnold Arboretum; C—Carnegie Museum; G—Gray Herbarium; M—University of Minnesota; N—New York Botanical Garden; O—National Museum of Canada.

No claim whatever is made to finality in the naming of critical specimens. There are so many of these intermediate forms, and their positions in relation to the principal species complexes are often so problematical, that at best the disposition I have made of them can represent little more than a series of opinions. Someone with a slightly different concept of the major species would arrive at entirely different conclusions.

I am deeply indebted to a number of persons and institutions for assistance. Thanks are due particularly to Dr. Abbe for entrusting me with his collections and for his patience with delays in working them up. Professor M. L. Fernald has, as usual, been a constant source of aid and inspiration. The authorities at the National Herbarium of Canada have rendered great assistance, in these days of limited travel, by loaning their large collection of willows from the region in question; and Dr. H. A. Gleason, Curator of the New York Botanical Garden, very kindly gave me access to the collections in his charge.

ARTIFICIAL KEY TO THE SPECIES BASED ON WELL-DEVELOPED FLOWERING OR FRUITING SPECIMENS

A. Bracts of the pistillate flowers not persistent in fruit, straw-colored; stamens 2, 3, or more; aments coetaneous or serotinous, borne on leafy peduncles; usually rather tall shrubs of alluvial shores, or occasionally of muskeg swamps .....SERIES I (p. 89).

A. Bracts of the pistillate flowers (at least toward the apex) brownish, yellowish-brown, fuscous, or atrofuscous, more rarely straw-colored, persistent in fruit; stamens 1 or 2; aments appearing before or after the leaves, sessile or pedunculate.

B. Pistillate flowers with two glands, ventral and dorsal to the pedicel; prostrate, repent shrubs; filaments (unknown in *S. jejuna*) more or less pilose .....SERIES II (p. 89).

B. Pistillate flowers with only one gland, ventral to the pedicel; repent or upright shrubs; staminate flowers with one or two glands; filaments pilose or glabrous.

C. Low, prostrate shrubs with rooting branches, or very small suffruticose plants; aments coetaneous or very often serotinous; the leaves mostly well-developed at anthesis. SERIES III (p. 89).

C. Erect or arborescent shrubs, with branches never repent and rooting (though many species are of very low and spreading form); aments usually appearing before or with the leaves .....SERIES IV (p. 90).

Series I

1. Petioles provided, toward the upper end or at the base of the blade, with distinct, often irregularly lobulate glands; leaves distinctly and rather closely serrate-dentate; aments mostly coetaneous but sometimes serotinous, borne singly on foliolate peduncles; ovary usually on a distinct pedicel 2–4 times longer than the gland; stamens 3 or more in each flower.
   2. Mature leaves distinctly whitened or glaucescent beneath, the blades elliptic-lanceolate and rather short-acuminate at the apex; aments often appearing late in the season, short-cylindric, scarcely twice longer than thick; capsule 7–12 mm. long, on a pedicel about ⅕ as long ..... 1. *S. serissima.*
   2. Mature leaves green on both sides, though often somewhat paler green beneath, broadly ovate, elliptic, or elliptic-lanceolate, more or less abruptly caudate-acuminate; aments coetaneous, frequently 2.5–3 times longer than thick; capsule 4.5–6.5 mm. long, with a relatively longer pedicel ..... 2. *S. lucida.*
1. Petioles or bases of the blades without glands; leaves linear or linear-lanceolate, subentire or rather distantly and often subspinulosely serrate; aments usually serotinous, sometimes appearing 2 or 3 on the same peduncle or lateral branchlet; capsule short-pediceled, the pedicel hardly more than twice as long as the gland; stamens 2..... 3. *S. interior.*

Series II

1. Aments mostly very short, and borne laterally on the branchlets; capsules 3–4 mm. long; lateral veins of the small, rounded, reticulate-veined leaves, even those near the base, clearly rising from the midrib; rare, prostrate species from near the Straits of Belle Isle ..... 6. *S. jejuna.*
1. Aments borne pseudo-terminally; capsules 4–7 mm. long; lateral veins of the leaves as in the last, or fewer, with two or three pairs rising from near the lower end of the midrib; leaves prominently reticulate-veined, rather coriaceous in texture.
   2. Prostrate shrubs, with leaves glabrous or nearly so; lateral veins of the leaves few, the lower ones rising from near the base; petioles elongate (up to 3 cm.); capsules scarcely over 4.5 mm. long; floral bracts only short-pilose on the inner surface ... 4. *S. reticulata.*
   2. Shrubs with prostrate or erect branchlets; leaves usually conspicuously silky-pilose on both sides (or occasionally glabrate), the veins well-scattered along the midrib; petioles not much longer than the buds; capsules 5–7 mm. long; floral bracts more or less silky-pilose on both sides ..... 5. *S. vestita.*

Series III

1. Ovaries and pedicels glabrous, even when young; leaves mostly crenate-dentate or glandular-crenate-denticulate (or usually entire in *S. arctophila* f. *lejocarpa*).
   2. Leaves of the same color on both sides, green, usually very small, crenate-dentate, usually rounded or often cordate at the base, sometimes retuse at the apex; floral bracts more or less uniformly colored, yellowish or violet, sparingly short-pilose; tiny arctic plants with semi-herbaceous stems and short, few-flowered aments ..... 8. *S. herbacea.*
   2. Leaves distinctly paler beneath, often pruinose.
      3. Ovaries with distinct pedicels, even when young, the pedicels of the capsules nearly always 2–3 times longer than the glands; adult leaves entire or at most inconspicuously glandular-denticulate or crenate, never marcescent. 10. *S. arctophila* f. *lejocarpa.*
      3. Ovaries subsessile, or the pedicels, even in fruit, somewhat shorter or scarcely longer than the glands; leaves glandular-crenate-denticulate (at least toward the middle and apex), the mature ones marcescent, partly long-persistent; prostrate, matted shrubs with tiny leaves; common on the Labrador Peninsula ..... 7. *S. Uva-ursi.*
1. Ovaries (sometimes only in part or only the pedicels) more or less densely pilose; capsules sometimes glabrescent; leaves entire or at most inconspicuously glandular-denticulate or crenate.
   4. Bracts of two colors, fuscous at the apex or over a large part of the surface, more or less long-silky toward the apex, sometimes only ciliate at the apex.
      5. Ventral glands rather short and broad, scarcely twice as long as thick, broadly truncate at the apex, ½ the length of the pedicels of the fruit; common species of arctic habitats, with prominent, upright, reddish aments ..... 10. *S. arctophila.*

5. Glands oblong, mostly 2½–4 times longer than thick; pedicels of the fruit shorter than the glands or rarely a little longer.
6. Leaves ovate or ovate-elliptic, oval or obovate-oblong, often plicate at the apex, rounded to broadly cuneate at the base, glabrous or nearly so, green and shining above, resembling those of *S. arctophila,* though somewhat narrower; rare species of the west and northwest coasts of Hudson Bay .....11. *S. hudsonensis.*
6. Leaves variously shaped, from elliptic-obovate to broadly rounded-ovate, green above, but scarcely shining, silky-hairy at least when young; a common and highly variable species as represented in Eastern Arctic America .....9. *S. arctica* vars.

4. Bracts uniformly colored, straw-colored, yellowish, or light brown, rather short-pilose (the hairs shorter than the bracts), sometimes glabrate on the inner surface.
7. Petioles very short, rarely up to 2 mm. long; rare, prostrate species of northern Hudson Bay and the arctic continental coast .....15. *S. fullertonensis.*
7. Petioles well-developed, mostly over 2 mm. long; the more prostrate forms of the commonly erect .....13. *S. cordifolia.*

Series IV

1. Ovaries and pedicels glabrous, even when young.
2. Pedicels distinct, even at anthesis 2–6 times as long as the glands; styles (and stigmas) short.
3. Bracts uniformly colored, yellowish or yellowish-brown, in life sometimes a little reddish, often becoming brown in drying; aments coetaneous, even the flowering ones borne on foliolate peduncles.
4. Leaves giving off a balsamic odor, even long after they are dried; leaflets and leaves glandular-crenate-serrate all around, very often cordate at the base, broadly ovate, elliptic, or elliptic-oblong; petioles 5 mm. long or more; glands short, somewhat thicker than long; capsules rostrate, 7–9 mm. long exclusive of the pedicels. 21. *S. pyrifolia.*
4. Leaves not giving off a balsamic odor; leaflets and leaves entire, not cordate, narrowly lanceolate to broadly oblanceolate, elliptic-lanceolate, or elliptic; petioles, even of the mature leaves, scarcely more than 6 mm. long; glands oblong-ellipsoid; capsules rather obtusely conic, 6–7 mm. long exclusive of the pedicels; erect shrubs, 1–3 ft. high, of bogs and wet shores .....30. *S. pedicellaris* var. *hypoglauca.*
3. Bracts of two colors, fuscescent for the most part or at the apex; flowering aments subsessile on the branchlets.
5. Styles 1–1.25 mm. long; aments at anthesis 2.5–3.5 : 0.9 cm., in fruit up to 8 : 2 cm. (exclusive of the peduncles); capsules 9–10 mm. long exclusive of pedicels 2–2.5 mm. long; upper leaf surfaces bright green and more or less shining; shrub up to 16 ft. high, of gravelly shores and alluvium .....19. *S. glaucophylloides.*
5. Styles hardly over 0.8 mm. long; aments and capsules shorter; upper leaf surfaces rather dull green.
6. Flowering twigs more or less yellow or flavescent; capsules 4–5 mm. long exclusive of pedicels 1.5–3 mm. long; tall shrubs of river flood plains ...17. *S. lutea.*
6. Flowering twigs fuscous, brownish or castaneous.
7. Leaves glaucous beneath; medium to tall shrubs of wet soil .....16. *S. cordata.*
7. Leaves of the same color on both sides (except in *myrtillifolia* var. *brachypoda*) or only a little paler green beneath; low, spreading shrubs of mossy bogs. 18. *S. myrtillifolia.*

2. Pedicels none or short, even in fruit not more than twice as long as the glands; styles (and stigmas) varying in length.
8. Stipules of the preceding year persistent; aments thick-cylindric, sessile, 1–3 pseudoterminal toward the ends of short twigs; branchlets, at least when young, densely hirsute-villous or woolly.
9. Stipules linear- to half-cordate-lanceolate, acuminate, glandular-serrate-dentate; twigs of the year hirsute-tomentose; leaves obovate-elliptic or elliptic-lanceolate or obovate-oblong; petioles 5–15 mm. long; mostly upright, medium shrubs of the northwestern part of our area .....22. *S. Richardsonii.*
9. Stipules half-cordate to reniform, entire or glandular-denticulate; twigs of the year hirsute-lanate; leaves broadly ovate or elliptic-orbicular, often cordate at the base; petioles commonly not over 2, or scarcely ever over 4 mm. long; mostly low, erect, spreading or matted shrubs .....23. *S. calcicola.*

8. Stipules none or not persistent; aments often coetaneous, sessile or pedunculate, for the most part distinctly lateral.
10. Aments, even in flower, distinctly pedunculate, provided at the base with small, rather normal leaflets; pubescence of the bracts scarcely or not at all curly.
11. Leaves distinctly glandular-serrate with fine teeth, often fimbriate, more or less densely pilose .....20. *S. adenophylla.*
11. Leaves entire, sparsely floccose-lanate .....24. *S. Wiegandii.*
10. Aments, even in fruit, sessile or subsessile, provided at the base only with very small, scale-like leaflets; pubescence of the bracts more or less distinctly curly.
12. Medium to tall shrubs of low ground .....16. *S. cordata.*
12. Low, spreading shrubs of mossy bogs .....18a. *S. myrtillifolia* var. *brachypoda.*
1. Ovaries (rarely only the pedicels or the base of the ovaries) pilose.
13. Pedicels distinct, even at anthesis 2–6 times as long as the glands.
14. Bracts uniformly colored, yellowish-straw-colored or yellowish-brown; aments coetaneous.
15. Styles none or very short, not longer than the short-oblong stigmas; pubescence of the leaves villous-tomentose or the leaves glabrescent; medium or tall shrubs, commonly in dry or damp woods and thickets .....29. *S. Bebbiana.*
15. Styles distinct, equaling or somewhat longer than the stigmas.
16. Pubescence of the leaves silvery-silky; flowering twigs glabrous, fuscous; capsules, exclusive of the pedicels, 4.5–5.5 mm. long; low, erect or bushy shrubs of arctic and alpine habitats .....40. *S. argyrocarpa.*
16. Pubescence of the leaflets and flowering twigs villous-tomentose; capsules about 7 mm. long, exclusive of the pedicels; tall shrubs, 10–14 ft. high, of Newfoundland and the Mingan Islands .....28. *S. cryptodonta.*
14. Bracts of two colors, fuscescent for the most part or toward the apex; aments often precocious.
17. Stigmas rather long, 4–5 times longer than thick, mostly 1–1.5 (–2) mm. long, longer than the styles which are often obsolete; capsules 7–14 mm. long exclusive of pedicels 1–3.5 mm. long; large shrubs of low, wet ground .....33. *S. discolor.*
17. Stigmas short-oblong, scarcely over 3 times longer than thick, usually less than 1 mm. long; styles evident, about as long as the stigmas; capsules usually shorter than in the last; medium shrubs of dry woods and barrens .....32. *S. humilis.*
13. Pedicels none or short, even in fruit scarcely more than twice as long as the glands.
18. Flowering twigs more or less distinctly pruinose; aments precocious; pubescence of the leaves distinctly lustrous; tall shrubs of swamps and alluvium .....36. *S. pellita.*
18. Flowering twigs not pruinose, or if so the leaves glabrous; pubescence of the leaves if present dull or silvery-silky.
19. Bracts of the flowers uniformly colored, yellowish-straw-colored or yellowish-brown.
20. Petioles very short, mostly 1–2 mm. long, not exceeding well-developed buds; stipules about equaling or twice as long as the petioles.
21. Prostrate shrubs with rooting branches; rare species of northern Hudson Bay and the continental arctic coast; aments in fruit cylindric, 2 : 1 to 4 : 1.3 cm. 15. *S. fullertonensis.*
21. Small upright shrubs with branches often rather short and somewhat twisted; aments short-oblong to spherical .....14. *S. brachycarpa.*
20. Petioles well-developed, longer than the buds or stipules.
22. Leaves usually much longer than broad, those of the peduncles oblong, about 2.5–3.5 times longer than wide; aments usually loosely flowered toward the base.
23. Leaves subcoriaceous, glabrous or glabrate (sparsely pilose when young), closely resembling those of *S. pedicellaris* var. *hypoglauca* ..31. *S. simulans.*
23. Leaves not coriaceous, silky-pubescent when young and often rather tardily glabrate.
24. Styles very short, sometimes divided nearly to the base, much less than 1 mm. long; plants of the Hudson Bay region, mostly low or medium shrubs. 12. *S. glauca.*
24. Styles distinct, 1 mm. long; rare species of N. Newfoundland; shrubs, up to 6 or 7 ft. high .....37. *S. amoena.*
22. Leaves usually short-oblong or -ovate to rounded, those of the peduncles broader and shorter, scarcely up to 2.5 times longer than broad; low, spreading, or matted shrubs .....13. *S. cordifolia.*

19. Floral bracts of two colors, fuscous in large part or at least toward the apex.
25. Twigs, even the flowering ones, more or less tomentulose or villosulous, more densely pilose when young (try also *S. paraleuca,* which has the flowering twigs ashy-pilose when young).
26. Aments, even in fruit, hardly over 5: 1.5 cm. excluding the peduncles; ovaries covered with a dense, subfloccose or subfarinaceous tomentum; capsules ellipsoid-conic, 7–8 mm. long excepting the pedicels which are scarcely 1 mm. long; upright bog shrubs of medium or small stature, usually with a hoary appearance .....27. *S. candida.*
26. Aments, even in flower, mostly over 4 cm. long, in fruit up to 7–13 cm., the pubescence not at all farinaceous.
27. Stipules oblique- or half-cordate-ovate; leaves glabrescent beneath or sparsely floccose-lanate; petioles not dilated at the base.
28. Leaves large (up to 20 cm. long), crenate, glabrescent beneath; petioles 1–2 cm. long; styles 0.5–1 mm. long; tall shrubs up to 16 ft. high. 26. *S. laurentiana.*
28. Leaves smaller, mostly 1.5–4 cm. long, entire, loosely floccose-lanate on both sides; petioles 3–8 mm. long; styles up to 2 mm. long; low, spreading shrubs scarcely over 1 ft. high .....24. *S. Wiegandii.*
27. Stipules linear-lanceolate; leaves covered beneath with a very dense, opaque, soft, white tomentum, glabrate above; petioles dilated toward the base, often partially covering the buds; stout shrubs with heavily greyish- to white-pubescent twigs, known in our region only in the northwestern and northern Hudson Bay districts .....25. *S. alaxensis* var. *obovalifolia.*
25. Flowering twigs, and often even the young ones, glabrous, or ashy-pilose when young and soon glabrate.
29. Styles short, 0.2–0.8 mm. long; capsules 3.5–7.5 mm. long, blunt; aments rather narrowly cylindric; leaves definitely crenate-dentate or rather sharply and finely serrate, more or less fulvous-silky when young.
30. Capsules very short, 3.5–4 mm. long; leaves oblanceolate or oblanceolate-oblong, crenate-dentate; rare, tall shrubs of the Gulf of St. Lawrence area. 35. *S. paraleuca.*
30. Capsules 5–7.5 mm. long; leaves rather narrowly lanceolate or elliptic-lanceolate, sharply and finely glandular-serrate, short-silky-villous beneath or glabrate in age; known in our region only on the west coast of Hudson Bay. 39. *S. arbusculoides.*
29. Styles longer, 0.8–1.5 mm. long; capsules 5–8 mm. long, lanceolate-ovoid to conic-rostrate; aments somewhat thicker or short-cylindric; leaves entire or remotely undulate, or rather indistinctly glandular-crenate-denticulate, nearly or entirely glabrous even when young.
31. Aments definitely pedunculate, the peduncles 1–3.5 cm. long, leafy.
32. Floral bracts yellowish, 2–3 mm. long; styles 1 mm. long; pedicels 1–1.5 mm. long, but little longer than the glands; rare shrubs of N. Newfoundland, up to 6 ft. tall .....37. *S. amoena.*
32. Floral bracts blackened, 3.5–4.5 mm. long; styles 1.2–1.5 mm. long; pedicels 1.5–2 mm. long, twice as long as the glands; low to medium shrubs, up to 5 ft. high, of N. Newfoundland; rare .....36. *S. pedunculata.*
31. Aments sessile or nearly so, with a few short bracts at the base; tall spreading shrubs of swamp margins, or low and spreading in arctic or alpine habitats .....34. *S. planifolia.*

1. **Salix serissima** (L. H. Bailey) Fernald in Rhod. **6:** 6 (1904); Macoun, J. M. in Ottawa Nat. **20:** 139 (1906); Schneider in Jour. Arn. Arb. **1:** 13–14 (1919), **3:** 63 (1921); Ball in Bot. Gaz. **72:** 220 (1921), in Can. Field Nat. **40:** 147 (1926).— *S. lucida* Muhl. var. *serissima* L. H. Bailey ex Arthur in Bull. Geol. Nat. Hist. Surv. Minn. **3:** 19 (1887).

No specimens of *S. serissima* have been collected from our area in recent years. Knowledge of its existence there rests upon early collections by Spreadborough and the Macouns, all of which I have seen. Schneider gives its northern limits in Newfoundland (Valley of Exploits R.), Anticosti I., the eastern shores of

James Bay, and the Severn R. He does not cite any specimens except the one from Severn R. (*J. M. Macoun 2028,* O). There are fragments of this specimen in the Gray Herbarium, as well as fragments of a collection by J. M. Macoun on Berens R., Man. (*no. 24618*), and from one by John Macoun on Anticosti (*no. 24584*). The original of the last is at Herb. O. All of these were cited by J. M. Macoun in 1906 (l. c.), together with a specimen from the mouth of the Albany R. (*Spreadborough 62628,* O, N), on the *west* coast of James Bay. It is presumed that Schneider saw all of the above specimens, and that his record for the *east* coast of James Bay is a mistake in the noting of Spreadborough's material. The Severn R. specimen may be located with fair accuracy by reference to A. P. Low's report on the survey between Lake Winnipeg and Hudson Bay in 1886 (G. S. C. Ann. Rept. **1886**: Pt. F. 1887).

The southwestern part of our area approaches the region of overlap for *S. serissima, S. lucida,* and their western relative, *S. lasiandra* Benth. The eastern limits of the latter are as yet uncertain, but specimens which I have provisionally so determined have been sent me by A. J. Breitung from various points along the Saskatchewan and Red Deer Rivers in east-central Saskatchewan. I have already noted the difficulty of distinguishing between *S. serissima* and *S. lasiandra* in northern Alberta where they occur together (Contr. Arn. Arb. **6**: 142–143, 1934; Jour. Arn. Arb. **17**: 228–229, 1936).

2. **Salix lucida** Muhl. in Neue Schr. Ges. Naturf. Fr. Berlin **4**: 239, *t. 6, fig. 7* (1803); Macoun, J., Cat. Can. Pl. 1[3]: 450 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88**: 70J (1889), 362L (1897); Schneider in Jour. Arn. Arb. **1**: 20 (1919), **3**: 63 (1921); Ball in Bot. Gaz. **72**: 227 (1921); St. John in Victoria Mem. Mus. Mem. **126**: 78 (1922); Wetmore in Rhod. **25**: 8 (1923); Fernald in Rhod. **28**: 177 (1926); Lewis in Can. Field Nat. **45**: 227 (1931).

Apparently confined to the southern parts of our area. Besides the typical form, two variations have been commonly recognized, both of which appear to have some geographic significance at least.

Leaves [17] more or less broadly ovate- or elliptic-lanceolate, rather abruptly caudate-acuminate: New twigs and new leaves glabrous or very soon glabrescent .....2. *S. lucida.*
Twigs of the current year, and sometimes in part those a year old, provided with a dirty grey or reddish pubescence; leaves rather pilose at the beginning, (reddish-)pilose at least on the veins beneath even in age .....2b. *S. lucida* var. *intonsa.*
Leaves more or less narrowly lanceolate, rather gradually acuminate.
2a. *S. lucida* var. *angustifolia.*

The following specimens may be assigned to typical *S. lucida:* MANITOBA: Hill (Hayes) R., Hudson Bay, *R. Bell 24585* (O).—ONTARIO: Moose Factory, *Spreadborough 62619* (O). —S. QUEBEC: Blanc Sablon, *Fernald & Wiegand 3146* (G); same, *Fernald & Long 27933* (G); Augustin R., *St. John 90349* (O, G); Romaine, *Lewis 130754* (O); Mingan R., *Victorin & Rolland 24797* (G); Seven Islands, Pt.-a-la-Marmite, *Victorin & Rolland 18884, 18886* (G).

2a. **Salix lucida** var. **angustifolia** Anderss. in Proc. Am. Acad. Sci. **4**: 54 (1858); Potter in Rhod. **3**: 279 (1934).—*S. lucida* f. *angustifolia* Anderss., Schneider in Jour. Arn. Arb. **1**: 22 (1919).

SPECIMENS EXAMINED: ONTARIO: Moose Factory, *Gardner 22* (A); same, *Todd June 9, 1941* (C); north end of Saw Pit I., Moose R., *Potter 911* (G); Bushy I., Moose R., *Potter 910* (G); Ship Sand I., Moose Factory, *Gardner 77* (A); East Pt., James Bay, *Todd June 28, 1941* (C).—N. QUEBEC: East Main, *Murie* (C).—LABRADOR: Head of Grand L., L. Melville distr., *Wetmore 102920* (O); along bank of Hamilton R. above Muskrat Falls, *M. T. Doutt 3159* (C).

[17] From Schneider, in Jour. Arn. Arb. **1**: 3 (1919).

2b. **Salix lucida** var. **intonsa** Fernald in Rhod. **6:** 2 (1904); Schneider in Jour. Arn. Arb. **1:** 22 (1919), **3:** 63 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 78 (1922); Wetmore in Rhod. **25:** 8 (1923); Lewis in Can. Field Nat. **45:** 227 (1931); Bowman in Rhod. **34:** 52 (1932), as *S. lucida.*

Forms with more or less permanent pubescence on twigs and leaves are separated as var. *intonsa.* They are known in our area on the north shore of the Gulf of St. Lawrence; and Wetmore collected one as far north as the shore of Grand Lake, a western extension of Lake Melville.

Specimens examined: Labrador: Head of Grand L., L. Melville distr., *Wetmore 102921* (O).—S. Quebec: Bradore Bay, *Lewis 130752* (O); Little Mecatina R., *Todd June 26, 1928* (C); Natashquan, *Townsend July 24–Aug. 10, 1912* (G); same, *Victorin & Rolland 28106, 28116* (G); Romaine, *St. John 90350* (O, G); Mingan, *Lewis 130753* (O); Mingan R., *Victorin & Rolland 24802* (O, G).—Mingan Islands: Ile a la Proie, *Victorin & Rolland 21687* (G), and Ile a la Chasse, *24947* (G).—Riv. au Renard, Anticosti, *Victorin & Rolland 27754* (G); Moisie R., *Bowman 275* (G).

3. **Salix interior** Rowlee in Bull. Torr. Bot. Cl. **27:** 253, *pl. 9, figs. 12, 13* (1900); see also Ball in Can. Field Nat. **40:** 175 (1926).—*S. longifolia* Muhl. not Lam., Schneider in Bot. Gaz. **67:** 340 (1919), in Jour. Arn. Arb. **3:** 65 (1921); Potter in Rhod. **36:** 279 (1934).

Within our region the sandbar willow, so far as present knowledge indicates, seems to be confined to the extreme southern end of James Bay and the rivers draining into it. It is to be expected, however, on many of the streams draining into the southwest sides of Hudson and James Bays. All the specimens that I have seen appear to represent the broader-leaved typical form rather than the narrow-leaved var. *pedicellata* (Anderss.) Ball, although the Gardner specimen (*no. 105*) and one of Potter's (*no. 895*) approach the latter.

Specimens examined: Ontario: Allen I., Abitibi R., *Potter 895* (G); Bushy I., Moose R., *Potter 894* (G); west shore of Moose R., opposite Ship Sand I., *M. T. Doutt 2149* (C); east shore of Hayes I., 2½ mi. E. of Moosonee, Moose R., *M. T. Doutt 2000* (C); Moose Factory, *Spreadborough 62621* (O); south shore of James Bay, *Gardner 105* (A).

4. **Salix reticulata** L., Sp. Pl. **2:** 1018 (1753); Macoun, J. in Geol. Surv. Can. Rept. Prog., **1879–80:** 64C (1881), Cat. Can. Pl. **1**[3]**:** 454 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889), **1895:** 362L (1897), **1898:** 36M (1901); Tyrrell in Geol. Surv. Can. Ann. Rept. **1896:** 213F (1898); Rydberg in Bull. N. Y. Bot. Gard. **1:** 260 (1899); Schneider in Bot. Gaz. **67:** 44 (1919), in Sargent, Pl. Wilson. **3:** 144 (1916), in Jour. Arn. Arb. **3:** 66 (1921); Fernald in Rhod. **28:** 177 (1926); Güssow in Can. Field Nat. **47:** 117 (1933); Størmer in Nyt. Mag. f. Nat. **32:** 266 (1933); Abbe in Rhod. **38:** 146 (1936); Raup in Mem. Carn. Mus. **12**[3]**:** 22 (1936); Grøntved in Rept. 5th Thule Exp. **2:** 34 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 151 (1940).

Although common on the Hudson Bay coasts and in the Arctic Archipelago (cf. Polunin, l. c.), this willow has not been extensively collected on the eastern Labrador coast, and not at all from the north shore of the Gulf of St. Lawrence. It occurs in northern Newfoundland, however, at the Straits of Belle Isle. Its known southern limit in the Hudson Bay area is on South Twin I. in James Bay. The species is exceedingly well marked, and even though specimens from our region probably could be found to represent various of the growth forms that have been described, I am inclined to agree with Polunin in disregarding them as of little taxonomic significance.

Specimens examined: Franklin: Lake Harbor, Baffin I., *Oldenburg 82* (M); Dorset, Baffin I., *Oldenburg 170A* (M); Nottingham I., *R. Bell 18849* (O).—Keewatin: Southampton I., *Sutton July 2, 23, 1929–30* (C); same, *Oldenburg 188C* (M); Mansfield I., *R. Bell 54350* (O); Rankin Inlet, *J. M. Macoun 79146, 79147* (O).—Manitoba: Churchill, *coll.?, July, 1931* (C); same, *Gardner 4* (O); same, *J. M. Macoun 79142* (O, G).—Ontario:

W. coast of Hudson Bay, lat. 56°, *J. M. Macoun 18850* (O); South Twin I., *M. T. Doutt 2267* (C); same, *J. M. Macoun 18847* (O); Raft R., W. coast of James Bay, *Spreadborough 6269* (O).—N. Quebec: Island near mouth of Seal R., Cape Jones, *Abbe & Marr 4140* (M, G); Little Cape Jones, *Sutton July 19, 1926* (C); mainland at S. end of Manitounuk Sd., *E. C. & L. B. Abbe 3971* (M, G); Bill of Portland I., *M. T. Doutt 2701* (C); Tukarak I., Belcher Isls., *J. K. Doutt 84, 125* (C); same, *Abbe & Marr 4057* (M, G); Little Whale R., *Low 63270* (O); along coast of Hudson Bay near Richmond Gulf, *Spreadborough 13661* (O).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3459, 3460* (M, G); Cairn I., *Abbe & Marr 3042* (M, G).—Port Harrison, *Todd July 2, 1930* (C); same, *Malte 120793, 120796* (O); Gilmore I., lat. 59° 50′, *Dutilly, O'Neill & Duman 87453* (G); Smith I., *Malte 120888* (O).—Labrador: Port Burwell, *Malte 126822* (O, G), *118644, 118645, 119992, 120022, 121056, 121062* (O); same, *E. L. Borden 63041* (O); Wakeham Bay, *Malte 118654, 120221* (O); Cape Chidley, *R. Bell 54349* (O); Clark Harbor, *Wynne-Edwards 7162* (O); Northwest Bank at head of Ryan's Bay, *Woodworth 143* (G); Nachvak, *R. Bell 54351* (O); Rowsell Harbor, lat. 58°. 58′, *Abbe & Odell 210* (O, G).—Newfoundland: Flower Cove, *Fernald, Long & Dunbar 26585* (G); same, *A. G. Huntsman Sept. 2, 1923* (G).

5. **Salix vestita** Pursh, Fl. Amer. Sept. **2:** 610 (1814); Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80:** 64C (1881), Cat. Can. Pl. 1[3]: 455 (1886); Macoun, J. M. in Geol. Surv. Can. **1895:** 362L (1897); Rydberg in Bull. N. Y. Bot. Gard. **1:** 260 (1899); Schneider in Bot. Gaz. **67:** 45 (1919), in Jour. Arn. Arb. **3:** 66 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922); Fernald in Rhod. **28:** 177 (1926); Lewis in Can. Field Nat. **45:** 228 (1931); Grøntved in Rept. 5th Thule Exp. **2:** 35 (1936); Abbe in Rhod. **38:** 146 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 153 (1940).

Salix vestita appears on the southeastern and western shores of Hudson Bay, and is common on the eastern Labrador coast down to the Straits of Belle Isle and Newfoundland. It also appears on the Mingan Islands. In Hudson Bay its known northern limits are at Churchill and Richmond Gulf, while its northern limit on the Atlantic side is at Akpatok I. (cf. Polunin, l. c.). On the Labrador coast it largely replaces the more arctic *S. reticulata*. Two varieties have been described which should be noted in our region. The following key (Fernald & St. John in Victoria Mem. Mus. Mem. **126**: 44, 1922) is useful in distinguishing these varieties.

Capsules narrowly ovoid, definitely tapering to the blunt tip; pistillate catkin 0.5–3 cm. long; staminate catkin 0.6–2 cm. long; leaves obovate or orbicular, usually somewhat retuse and reticulately veined.
  Leaves permanently clothed beneath with soft, white, silky pubescence; staminate catkin 1–1.5 cm. long; winter buds pubescent at least at the tip .....5. *S. vestita.*
  Leaves nearly glabrate beneath, a few hairs persisting on the veins, even the young leaves only sparsely clothed; staminate catkin 1.7–2.5 cm. long; winter buds quickly glabrate and lustrous .....5a. *S. vestita* var. *psilophylla.*
Capsules only slightly tapering to the broad rounded summit; pistillate catkin 2–5 cm. long; staminate catkin 1–3 cm. long; leaves elliptical or oblong, often subacute, usually plane above .....5b. *S. vestita* var. *erecta.*

Specimens examined (typical form): Ontario: Fort Severn, *J. M. Macoun 24819* (O).—N. Quebec: mainland at lower end of Manitounuk Sd., *E. C. & L. B. Abbe 3969* (M, G).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3087, 3777* (M, G); Cairn I., *Abbe & Marr 3058, 3535* (M, G); Beach Cr., *E. C. & L. B. Abbe 3292* (M, G).—Along Ungava R., *Spreadborough 13656* (O); Ungava Bay (Ft. Chimo), *L. M. Turner 6310* (G); same, *J. D. Soper 122086* (O).—Labrador: Kikkertaksoak, Saglek Bay, *Abbe 214* (G); near head of Nachvak, *Brooks 213* (G); same, *Woodworth 144* (G); same, *R. Bell 24811* (O); Rowsell Harbor, *Abbe & Odell 212* (O); Rama, *Sornborger 179* (G); Hebron, *Oldenburg 37A, 39C* (M); same, *Todd Sept. 16, 1926* (C); same, *Polunin 1013* (O); same, *J. D. Soper 122084* (O); same, *Wynne-Edwards 7061* (O); summit of Bishop's Mitre, Kaumajet Mts., *Abbe 216* (O, G); Ogualik I., *Brooks 215* (O, G); Cut Throat Harbor, S. of Cape Mugford, *A. E. Porsild 181* (O, G); Okkak, *Wynne-Edwards 7466* (O); Flint I., near Port Manvers, *Bryant 68* (G); same, *Dutilly, O'Neill & Duman 7649* (G); September Harbor, *Bishop 231* (O, G); same, *Sewell 11* (G); Hopedale, *Bishop 232* (O, G); Hamilton R.,

Asanipi Branch, *Low 6048* (O); Battle Harbor, *Waghorne 2* (A); "Capsan" I., *Waghorne 3* (pt.) (A).—S. Quebec & Newfoundland: Blanc Sablon, *Townsend July 29–31, 1915* (G); same, *Fernald & Wiegand 3199* (G); same, *Lewis 130688, 130689* (O); Flower Cove, Nfld., *A. G. Huntsman Sept. 2, 1923* (G); St. Anthony, Nfld., *Abbe 211* (O).—Mingan Islands and vicinity: Eskimo Pt., *Townsend June, 1909* (G); Eskimo I., *St. John 90377* (O, G); same, *Abbe 1113, 1118* (G); same, *Victorin & Rolland 18895, 18899, 18900* (G); Ile St. Charles, *Victorin & Rolland 18896, 18897, 24800* (G); Ile a la Proie, *Victorin & Rolland 21683* (G); Grand Ile, *Victorin & Rolland 21685* (G); Pte. aux Ammonites, *Victorin & Rolland 18898.*—Anticosti, Southwest Pt., *John Macoun 24813* (O); L. Mistassini, *coll.? 24812* (O).

5a. **Salix vestita** var. **psilophylla** Fernald & St. John in Victoria Mem. Mus. Mem. **126:** 44 (1922).

This plant, collected by St. John on limestone sea-cliffs, Eskimo I. (Mingan Isls.), *90378* (O, G), is distinguished by its thin, pale leaves which are glabrescent beneath.

5b. **Salix vestita** var. **erecta** Anderss. ex DC. Prod. **16**[2]: 300 (1868); Schneider in Bot. Gaz. **67:** 45–46 (1919), in Jour. Arn. Arb. **3:** 66 (1921).

A western, Rocky Mountain form of *S. vestita,* with more erect habit, was originally described as *S. Fernaldii* Blankinship in Mont. Agric. Coll. Sci. Stud. **1:** 46 (1905). Schneider, l. c., has pointed out that it can hardly be regarded as a species, and that Andersson's varietal name, *erecta,* should be used for it. The following are plants from our region which strongly suggest this variety.

Specimens examined: Manitoba: Churchill, *J. M. Macoun 79143* (O, G).—N. Quebec: Great Whale R., *M. T. Doutt 2620* (C); Bill of Portland I., *M. T. Doutt 2682* (C).—Labrador: Grand Falls, Hamilton R., *M. T. Doutt 3374* (C).—S. Quebec: Ile Ste. Genevieve (Mingan Isls.), *Victorin & Rolland 18901* (G).

Schneider annotated the Churchill specimen in the Gray Herbarium as "Difficult to distinguish from typical *vestita";* and the same may be said of the Doutt specimens from Hudson Bay and Grand Falls. They have a distinctly erect habit, and their leaves are somewhat narrowed and pointed. Still another eastern specimen in the Gray Herbarium, from Cap Rosier, Gaspé Co., Quebec (*Stebbins 839*) has been named var. *erecta.* Both this and the Mingan material (the latter is sterile) seem to represent the variety better than do those noted above. Their leaves are notably narrower than those of most eastern plants, and the ones from the Gaspé are nearly acute at the apex.

6. **Salix jejuna** Fernald in Rhod. **28:** 177 (1926).

So far as is known at present, this distinctive little species is confined to the region about the Straits of Belle Isle. When first described it was related to forms of *S. arctica,* which it most nearly resembles in habit and in the pattern of leaf venation. However, it proves to have two glands at the base of each flower, a character that brings it into the group containing *S. reticulata* and *S. vestita.* The rather strong reticulation of its leaves also suggests these species. It differs from them clearly in its leaf venation and in bearing its aments laterally, rather than pseudoterminally.

Specimens examined: Labrador: Henley I., Chateau Bay, *A. G. Huntsman Sept. 7, 1923* (G).—Northern Newfoundland: Cape Norman, *Wiegand & Long 27950* (G, type); Big Brook, Str. of Belle Isle, *Fernald, Wiegand & Hotchkiss 27986* (G); Four Mile Cove, Str. of Belle Isle, *Fernald, Wiegand & Long 27949* (G).

7. **Salix Uva-ursi** Pursh, Fl. Amer. Sept. **2:** 610 (1814); Bebb in Bull. Torr. Bot. Cl. **16:** 212 (1889); Macoun, J., Cat. Can. Pl. **1**[3]: 455 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 362L (1897), **1898:** 36M (1901); Rydberg in Bull. N. Y. Bot. Gard. **1:** 278 (1898); Schneider in Bot. Gaz. **67:** 50 (1919), in Jour. Arn.

Arb. **3:** 66 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922); Lewis in Can. Field Nat. **45:** 228 (1931); Abbe in Rhod. **38:** 147 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 154 (1940).

Common on the northern Quebec and Labrador coasts south at least to Great Whale R. on the west, and to the Gros Mecatina R. on the north shore of the Gulf of St. Lawrence. It extends north to southern Baffin Island (cf. Polunin, l. c.), and south to the New England mountains and the Adirondacks. It has not been collected on the west coast of Hudson Bay. The species is remarkably consistent throughout its range, though occasional specimens show intergradations with *S. arctophila* Cock. Polunin, l. c., has noted these in the eastern Arctic, and among the specimens cited below, *Abbe & Marr 3183* illustrates the same tendency. This plant has the habit, leaves, and ament-size of *S. Uva-ursi,* but it has the longer pedicels of *S. arctophila.* Schneider, l. c., has pointed out that Andersson's var. *labradorica* (DC. Prod. **16**[2]: 292, 1868), from near Okkak, is scarcely distinguishable from the typical form.

Specimens examined: N. Quebec: Near mouth of Great Whale R., *E. C. & L. B. Abbe 3983* (M, G); same, *M. T. Doutt 2532, 2543* (C); Bill of Portland I., *M. T. Doutt 2635* (C); Tukarak I., Belcher Isls., *J. K. Doutt 3, 11, 28, 61* (C); same, *Abbe & Marr 4056* (M, G).—Richmond Gulf: *Spreadborough 54361* (O); mainland S. of Cairn I., *Abbe & Marr 3085, 3160, 3161, 3183, 4185* (M, G); Beach Cr., *Marr 4369, 4376* (M).—Seal L., *Spreadborough 13655* (O); Nastapoka, *Murie June 16, 1915* (C); Port Harrison, *Todd July 2, 1930* (C); same, *Malte 120831* (O); same, *Oldenburg 230A* (pt.) (M); opposite Digges I., *Low 23035* (O); Sugluk, *Oldenburg 157B* (M); Wakeham Bay, *Malte 126941* (O, G); Fort Chimo, *Ney & Courtright 2435* (O); Port Burwell, *J. M. Macoun 79150* (O, G), *79151* (O); same, *Malte 126805, 126837* (O, G), *119995, 120039, 120065, 121050, 121052* (O); same, *Oldenburg 51B* (M); same, *L. E. Borden 63039* (O); Cape Chidley, *R. Bell 54362, 54363* (O).—Labrador: Valley of Bryant Lakes, Kangalaksiorvik, *Abbe 221* (O, G); Kangalaksiorvik Bay, *Bryant 67* (G); Razorback Mt., Ryan's Bay, *Woodworth 146* (G); Precipice Ridge, Torngat Mts., lat. 59° 15′, *Abbe 220* (G); vicinity of head of Nachvak Bay, *Woodworth 145, 148* (G); 20 mi. N. of Nakvak, *H. S. Forbes 64* (G); Kikkertaksoak I., Saglek Bay, *Woodworth 147* (G); Hebron, *Polunin 1014* (pt.) (O); same, *Wynne-Edwards 7093* (O); Cape Mugford Penins., *Abbe 219* (G); Nain, *R. Bell 18852* (O); same, *Bishop 233* (G); 15 mi. W. of Nain, *H. S. Forbes 66* (G); Anatolak, *Sewell 458* (pt.) (G); Davis Inlet, *L. M. Turner 629* (G); Hopedale, *Bishop 234* (G); same, *Sornborger 176* (G); L. Petitsikapau, *Low 6051* (O); Webeck Harbor, *Sornborger 9* (G); Tub Harbor, *Sornborger 8* (G); Cutthroat Harbor, *A. E. Porsild 180* (O); Salmon Bight, *A. E. Porsild 28* (O); Gready I., *Bryant 65* (G); same, *Bishop 235* (O, G); Fanny's Harbor, *Townsend 36* (G); Battle Harbor, *Waghorne 38* (A); same, *Abbe 218* (G); same, *Bishop 236* (G).—S. Quebec & Newfoundland: Blanc Sablon, *Fernald & Wiegand 3169* (G); same, *Abbe 1106* (G); same, *M. T. Doutt 3001* (C); Brest, *St. John 90375, 90376* (O, G); St. Anthony, Nfld., *Abbe 217* (O); Cross Harbor, Great Mecatina I., lat. 58° 52′, *Abbe 1120* (G).

8. **Salix herbacea** L., Sp. Pl. **2:** 1918 (1753); Macoun, J., Cat. Can. Pl. **1**[3]: 449 (1886); Bebb in Bull. Torr. Bot. Cl. **17:** 150 (1890); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 362L (1897), **1898:** 36M (1901); Tyrrell in Geol. Surv. Can. **1896:** 213F (1898); Rydberg in Bull. N. Y. Bot. Gard. **1:** 277 (1899); Schneider in Bot. Gaz. **67:** 52 (1919), in Jour. Arn. Arb. **3:** 67 (1921); Fernald in Rhod. **28:** 177 (1926); Güssow in Can. Field Nat. **47:** 117 (1933); Abbe in Rhod. **38:** 147 (1936); Grøntved in Rept. 5th Thule Exp. **2:** 34 (1936); Raup in Mem. Carn. Mus. **12**[3]: 22 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 155 (1940).

Schneider, l. c., says that *S. herbacea* "has almost exactly the same range as *S. Uva-ursi,*" but a glance at the maps shows that it has a considerably wider range in our region than the latter. True, its southern limits on the Labrador Peninsula and the New England mountains are approximately the same, but it has been collected several times on Southampton Island and on the northwest shores of Hudson Bay, where *S. Uva-ursi* has never been found. Also, it ex-

tends considerably farther north in the Arctic Archipelago than *S. Uva-ursi* (cf. Polunin, l. c.), reaching North Devon Island. Furthermore, although like *S. Uva-ursi* it is not represented in western Arctic America, it is a wide-ranging circumpolar species, while *S. Uva-ursi* is confined to northeastern America.

Specimens examined: Franklin: Nottingham I., *coll.? 54352* (O).—Keewatin: Fullerton, Hudson Bay, *J. M. Macoun 79149* (O, G); Chesterfield Inlet, *Sutton Aug.–Sept., 1930* (C); same, *J. W. Tyrrell 1717* (O); same, *Malte 120463* (O); Cape Eskimo, *J. M. Macoun 79145* (O).—S. Quebec: Flaherty I., Belcher Isls., *E. C. & L. B. Abbe 4104* (M, G); Tukarak I., Belcher Isls., *J. K. Doutt 203, 370* (C); same, *Abbe & Marr 4054* (M, G).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3768* (M, G); Whale I., *Abbe & Marr 3403* (M, G); Wiachewan Bay, *E. C. & L. B. Abbe 3406* (M, G); Fishing Lake Cr., *Abbe & Marr 3593, 3594* (M, G).—Along Ungava R., Aug. 18, 1896, *Spreadborough 13681* (O); Port Harrison, *Malte 127020, 127048* (O, G), *120745* (O); same, *Polunin 2233* (G); Wolstenholm, *Malte 120976* (O); opposite Digges I., *Low 54353* (O); Wakeham Bay, *Polunin 1380* (O); Diana Bay, *Dutilly, O'Neill & Duman 87125* (G); Payne Bay, *Ney & Courtright 2427* (O); Ungava Bay (Ft. Chimo), *L. M. Turner 627* (G); Cape Chidley, *R. Bell 18870* (O); Burwell, *Malte 126800* (O, G), *120019, 120053* (O); same, *Oldenburg 51A* (M); same, *L. E. Borden 63042* (O).—Labrador: head of Main Arm of Ikordlearsuk Bay, *Woodworth 149* (G); Eclipse Harbor, *H. S. Forbes 62* (G); vicinity of Ryan's Bay, *Woodworth 150, 151, 152* (G); Valley of Bryant Lakes, Kangalaksiorvik, *Abbe 225* (O, G); Kangalaksiorvik Bay, *Bryant 63* (G); Rama, *Sornborger 177* (G); Hebron, *Wynne-Edwards 7053* (O); Cape Mugford Penins., *Abbe 224* (G); Anatolak, *Sewell 457* (G); Hopedale, *Abbe & Hogg 223* (O, G); Rodney Mundy I., Indian Harbor, *Abbe & Hogg 222* (O, G); Webeck Harbor, *Sornborger 10* (G); Salmon Bight, lat. 53° 27′, *A. E. Porsild 21* (G), *27* (O); Battle Harbor, *Waghorne 112* (A); Emily Harbor, *Waghorne* (A).—Northwestern Newfoundland: Doctor Hill, Highlands of St. John, *Fernald, Long & Fogg 1588, 1589* (G).

9. **Salix arctica** Pall., Fl. Ross. 1[2]: 86 (1788).

The "*S. arctica* complex," as represented in America, has long been divided into two parts, eastern and western. Its basic nomenclature has been noted for its confusion; but Rydberg in 1899 and Schneider (more fully) in 1918 seem to have straightened it out sufficiently for the time being. There is no need to go into it here, but reference may be made to Schneider in Bot. Gaz. **66**: 117–135 (1918) for details. The chief concern at present is whether the two supposed entities, *S. arctica* Pall. in the west and *S. anglorum* Cham. principally in the east, are actually worthy of specific distinction. Schneider, who saw a large amount of material during his monographic studies, admitted great difficulty in naming many specimens in this group. Nevertheless he maintained the two species, with the following descriptive key characters to separate them (Bot. Gaz. **67**: 33–34):

Leaves not stomatiferous above,[18] usually obovate or obovate-oblong, rounded to subacute or plicate-acute at the apex, gradually or abruptly attenuate at the base or obtuse or sometimes rounded, the larger well-developed ones 3–6 : 2–4 cm.; petioles 9–20 mm. long; stipules on the vegetative branchlets ovate-lanceolate or lanceolate, entire or somewhat denticulate, 2–12 mm. long; aments at anthesis 2.5–4 cm. long, conspicuous with black, densely long-silky bracts, in fruit 6 : 1.3 up to 9 : 1.8 cm.; ovaries sessile or subsessile, silky-villous; styles distinct, usually entire, 2–2.5 times longer than the oblong bifid stigmas; capsules (6–) 8–10 mm. long exclusive of short pedicels ⅔ the length of the gland to scarcely shorter than the gland (very rarely a little longer) ..... *S. arctica* and vars.

Leaves stomatiferous above, usually smaller, exceedingly variable . . . petioles hardly over 10 mm. long; stipules none or smaller; aments even in fruit scarcely up to 5.5 : 1.5–1.8 cm., often distinctly smaller, more slender; capsules up to 7–8 mm. long exclusive of pedicels almost none or ½ to ⅓ the length of the glands ..... *S. anglorum* and vars.

[18] "With the exception of *S. arctica* var. *subcordata*, which, however, is easily distinguished from any of the forms of *S. anglorum* by its much larger leaves and longer stouter catkins."

This key summarizes the situation rather adequately, and it will be seen at once that except for the stomate character there is scarcely anything to distinguish the two species with the possible exception of size. Schneider expressed this quite clearly as follows (Bot. Gaz. **66**: 121): "Generally, *S. arctica* is a much more robust plant with larger leaves and catkins and thicker branchlets, but when we compare the shape and pubescence of the leaves and the different characters of the flowers and fruits it is rather difficult to express in words those signs that the eye can more or less easily perceive." He therefore set great store by the presence or absence of stomata on the upper leaf-surfaces, although this failed also for one of the varieties of *S. arctica* (see footnote, above), and for forms of *S. anglorum* both in the eastern and western parts of the latter's range. Forms collected at Herschel I., though they had the other characters of *S. anglorum*, had to be placed arbitrarily in *S. arctica* because they had no stomata on the upper leaf-surfaces.

With these things in mind, Polunin (l. c.) has ventured to unite the two forms under the older name, *S. arctica* Pall., and to consider that they are at best varietally separable. My own experience bears this out, but I think it advisable to maintain some sort of taxonomic distinction for the smaller, less robust form which is common in the eastern Arctic and which is now called *S. anglorum*. The earliest varietal name for this is var. *Brownei* Anderss. The following is a key to the recognized varieties of *S. arctica*.[19]

Leaves broadly ovate, ovate-rounded, obovate, broadly elliptic to orbicular, rounded or rather short-acute at the apex, or sometimes very short-plicate-apiculate, broadly cuneate or rounded to subcordate at the base, 1.5 : 1.2 to 3.5 : 2.8 cm., the broader ones sometimes 3.5 : 3 cm., the young leaves apparently always sparsely villosulous above and pilosulous on the midrib; aments rather closely flowered .....9b. var. *kophophylla*.

Leaves mostly ovate, elliptic, ovate-elliptic, obovate-elliptic, or rarely obovate-lanceolate, obtuse or acute at the apex, rounded or cuneate at the base, 1.5 : 1 to 5 : 2.9 cm., or the narrower, more acute ones 4 : 1.8 cm.

Leaves covered with silky hairs when young; aments closely flowered; young twigs blackish, purplish or flavescent .....9a. var. *Brownei*.

Leaves usually glabrous from the beginning; aments rather loosely flowered toward the base; twigs much elongated, yellowish .....9c. var. *araioclada*.

9a. **Salix arctica** var. **Brownei** Anderss. in DC. Prod. **16**^{2}: 286 (1868).—*Salix arctica* Pall., Rydberg in Bull. N. Y. Bot. Gard. **1**: 266 (1899), as to *Bell 18825* (O), from Hudson Str.; Grøntved in Rept. 5th Thule Exp. **2**: 32 (1936); Polunin in Nat. Mus. Can. Bull. **92**: 157 (1940).—*S. arctica* R. Br., Macoun, J., Cat. Can. Pl. 1^3: 444 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88**: 70J (1889), **1895**: 361L (1897), **1898**: 36M (1901).—*S. Brownii* Bebb in Bot. Gaz. **14**: 115 (1889); Macoun, J., Cat. Can. Pl. 2^5: 356 (1890); Tyrrell in Geol. Surv. Can. Ann. Rept. **1896**: 213F (1898).—*S. anglorum* Cham., Rydberg in Bull. N. Y. Bot. Gard. **1**: 266 (1899), in part; Fernald in Ott. Nat. **13**: 98 (1899); Schneider in Bot. Gaz. **66**: 126 (1918), in Jour. Arn. Arb. **3**: 67 (1921); ? St. John in Victoria Mem. Mus. Mem. **126**: 79 (1922); Wetmore in Rhod. **25**: 8 (1923); Raup in Mem. Carn. Mus. 12^3: 22 (1936), in part; Abbe in Rhod. **38**: 147 (1936).

Variety *Brownei* is widespread in the eastern Arctic (cf. Polunin, l. c.). It is apparently common throughout the Archipelago and west along the arctic coast of the continent at least to Cape Bathurst. In the Hudson Bay district it reaches its known southern limits near Cape Eskimo on the west coast (cf. Grøntved, l. c.) and at Port Harrison on the east coast. On the outer Labrador it is known only as far south as Hopedale, lat. 55° 27′.

[19] Modified from Schneider's key in Bot. Gaz. **66**: 126–134 (1918).

SPECIMENS EXAMINED: KEEWATIN: Southampton I., *Sutton,* several specimens collected *July 2, 3, 10, 30, 1929–30* (C); same, *Oldenburg 188B* (M); Fullerton, lat. 64°, *L. E. Borden 63050* (O); Chesterfield Inlet, *Sutton Aug.–Sept., 1930* (C); same, *Malte 120416* (O); same, *Freuchen 734* (O).—N. QUEBEC: Port Harrison, *Malte 127034, 127039* (O, G), *120867* (O); Smith I., *Malte 120882, 120889, 120901, 120903, 120915, 120917* (O); opposite Digges I., *A. P. Low 23037* (O, A); Nottingham I., *R. Bell 24623* (O); Sugluk, *Oldenburg 157C* (pt.) (M); Wakeham Bay, *Malte 118617, 120222, 120234, 120253* (O); Prince George Sd., *R. Bell 18785a* (O); Diana Bay, *Ney & Courtright 2402* (O); Ungava Bay (Ft. Chimo), *L. M. Turner 4817* (G); Port Burwell, *Malte 126798, 126803, 126804, 126816, 126835, 126819, 126820* (O, G).—LABRADOR: head of Main Arm of Ekortiarsuk Bay, *Woodworth 153* (G); Eclipse Harbor, *H. S. Forbes 82* (G); Kangalaksiorvik Bay, *Bryant 81, 84, 85, 86, 87* (G); Valley of Bryant Lakes, Kangalaksiorvik, *Abbe 232* (G); 20 mi. N. of Nachvak, *H. S. Forbes 83* (G); Bishop's Mitre, Kaumajet Mts., *Abbe 233* (O, G); Hebron, *Mrs. G. K. Tallman July 20, 1936* (M); Hopedale, *Abbe & Hogg 227* (G).

9b. **Salix arctica** var. **kophophylla** (Schneider) Polunin in Jour. Bot. **77:** 271 (1939), in Nat. Mus. Can. Bull. **92:** 157 (1940).—*S. anglorum* Cham. var. *kophophylla* Schneider in Bot. Gaz. **66:** 130 (1918), in Jour. Arn. Arb. **3:** 67 (1921); Woodworth in Rhod. **29:** 56 (1927); Abbe in Rhod. **38:** 147 (1936).

When originally described by Schneider this variety was known only in the Gaspé region and Newfoundland; but it has since been collected on the outer Labrador coast at several points, and Polunin gives it a rather wide range in the more southern arctic islands. Polunin also cites specimens from various points in northern Quebec and Labrador, and one from Chesterfield Inlet collected by *Malte* (*120566,* O) which I believe is *S. arctophila.*

SPECIMENS EXAMINED: N. QUEBEC: Port Harrison, *Malte 120760, 120817, 120820* (O); Cape Smith, *Polunin 1301* (O), *1349* (G); Prince George's Sd., *R. Bell 18785b* (O); Port Burwell, *Malte 118598, 120005, 120170, 120172* (O); same, *Polunin 1101* (O).—LABRADOR: Valley of Bryant Lakes, Kangalaksiorvik, *Abbe 231* (O, G); head of Nachvak Bay, *Woodworth 154* (G); Battle Harbor, *Abbe 226* (G).

9c. **Salix arctica** var. **araioclada** (Schneider) comb. nov.—*S. anglorum* Cham. var. *araioclada* Schneider in Bot. Gaz. **66:** 133 (1918), in Jour. Arn. Arb. **3:** 67 (1921); Abbe in Rhod. **38:** 147 (1936).

Known in our region only from two collections in northern Labrador. Like var. *kophophylla,* it had only a limited known range in the northeast (Gaspé Peninsula) when described by Schneider; but it is distinctive in this group for having representatives in the Rockies and Selkirks of Alberta and British Columbia.

SPECIMENS EXAMINED: LABRADOR: The Four Peaks, Torngat Mts., lat. 59° 25′, *Abbe 229* (O, G); Kangalaksiorvik, lat. 59° 18′, *Abbe 228* (G).

10. **Salix arctophila** Cockerell ex Heller, Cat. N. Amer. Pl. 89 (1910); Schneider in Bot. Gaz. **67:** 57 (1919), in Jour. Arn. Arb. **3:** 68 (1921); Fernald in Rhod. **28:** 178 (1926); Lewis in Can. Field Nat. **45:** 228 (1931); Abbe in Rhod. **38:** 147 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 159 (1940).—*S. groenlandica* Lundström in Nov. Act. Reg. Soc. Sci. Upsala **3:** 36 (1877); Rydberg in Bull. N. Y. Bot. Gard. **1:** 267 (1899); Schneider in Bot. Gaz. **66:** 140 (1918).

Apparently common throughout most of our region. Its southern limits appear to be on South Twin Island in James Bay, and on Newfoundland and the Gaspé Peninsula in the east. Polunin says that it is "fairly general" in southern Baffin Island, but in the northern arctic islands it is more local. It has been collected at several points on the west coast of Hudson Bay, and westward in the Great Lake region of the Mackenzie basin (cf. Raup in Jour. Arn. Arb. **17:** 230, 1936). The species is rather consistent and distinctive in form, although intermediates between it and *S. Uva-ursi* or *S. arctica* var. *Brownei* are not infrequent (cf. Polunin, l. c., pp. 154, 159). Forms with glabrous capsules appear occasionally

throughout the range of the species, and are called f. *lejocarpa* (Anderss.) Fernald in Rhod. **28**: 178 (1926) (*S. arctica* γ *groenlandica* var. *lejocarpa* Anderss., DC. Prod. **16**^{2}: 287, 1868).

SPECIMENS EXAMINED: FRANKLIN: ? Cape Dorset, Baffin I., *Oldenburg 170A* (pt.).—KEEWATIN: South Bay, Southampton I., *Sutton June 27, July 20, 1929–30* (C) (cited under *S. anglorum* in Raup, Mem. Carn. Mus. **12**^{3}: 22); same coll. and locality, *July 10, Aug. 2, 1929–30* (C) (cited under *S. cordifolia* var. *callicarpaea* in Raup, l. c.); Chesterfield Inlet, *Polunin 2148* (pt.) (O), *90, 1764, 2237* (G); same, *Malte 120566* (O); same, *Gardner 355* (G); between L. Athabaska and Chesterfield Inlet (Dubawnt L.), *Tyrrell 18834* (O).—MANITOBA: Churchill, *J. M. Macoun 79168* (O, G); same, *Gardner 41* (A); west coast of Hudson Bay, lat. 57°, *J. M. Macoun Aug., 1886* (A).—ONTARIO: South Twin I., James Bay, *M. T. Doutt 2268, 2321, 2394, 2397* (C); same, *J. M. Macoun 18827* (O).—S. QUEBEC: Island near mouth of Seal R., Cape Jones, *Abbe & Marr 4126* (M, G); near Great Whale R., *Spreadborough 54354* (O); same, *Low 63269* (O), *63271?* (O); Bill of Portland I., *M. T. Doutt 2645* (C).—Belcher Isls.: Tukarak I., *Abbe & Marr 4081* (M, G); same, *J. K. Doutt 12, 329* (C).—Richmond Gulf: *Spreadborough 54355* (O); mainland S. of Cairn I., *Abbe & Marr 4264, 4265* (M, G); Beach Cr., *Abbe & Marr 3271* (M, G); Cairn I., *Todd July 31, 1926* (C); same, *Abbe & Marr 3028, 3029, 3487* (M, G).—Nastapoka R., *Murie July 6, 1915* (C); along Ungava R., Aug. 6, 1896, *Spreadborough 13687b* (O); Port Harrison, *Malte 127016* (O, G); same, *Todd June 12, 1930* (C); same, *Oldenburg 230A* (pt.) (M); Cape Smith, *Oldenburg 212A* (M); northern Ungava, *Low 24774* (O); Erik Cove, Hudson Str., *Low 23039* (O); Digges I., *R. Bell 18825* (O); Sugluk, *Oldenburg 157C* (pt.) (M); Sugluk West, *Polunin 1536* (O); Cape Prince of Wales, *R. Bell 18831* (O); Port Burwell, *Malte 126775* (O, G), *120007, 120013, 120023, 120074, 120124, 120126* (O).—LABRADOR: Bowdoin Harbor, *Sewell 129* (G); Eclipse Harbor, *Dutilly, O'Neill & Duman 87001* (G); head of Main Arm of Ekortiarsuk Bay, *Woodworth 161* (G); Razorback Mt., Ryan's Bay, *Woodworth 157* (G); Northwest Bank, at head of Ryan's Bay, *Woodworth 155, 156* (G); Kangalaksiorvik, *Bryant 77, 79* (G); 20 mi. N. of Nachvak, *H. S. Forbes 78, 80* (G); head of Nachvak Bay, *Woodworth 158* (G); Big I., Saglek Bay, *Gardner 193* (G); Kikkertaksoak I., Saglek Bay, *Woodworth 159* (G); head of North Arm of Saglek Bay, *Woodworth 160* (G); Hebron, *Oldenburg 5* (M); same, *Polunin 1014* (pt.) (O); same, *Wynne-Edwards 7094* (O); Cape Mugford, *Todd Aug. 2, 1920* (C); mouth of Fraser R., lat. 57°, *Bishop 237* (G); 15 mi. W. of Nain, *H. S. Forbes 91* (G); Ford Harbor, *R. Bell 18833* (O); Anatolak, *Sewell 460* (G); Cape Harrigan, lat. 55° 50′, *Bishop 238* (G); Windy Tickle, lat. 55° 45′, *Bishop 239* (G); Hopedale, *Sornborger 2* (G); same, *Bishop 240* (O, G); Webeck Harbor, *Sornborger 5* (G); Turnavik, *J. M. Macoun 79158* (O, A); same, *A. E. Porsild 90, 91, 92* (O); Indian Harbor, *Bishop 241* (G); Rodney Mundy I., Indian Harbor, *Abbe & Hogg 235* (G); Cut Throat I., *Dutilly, O'Neill & Duman 7201* (G); Gready I., *H. S. Forbes 76* (G); Salmon Bight, lat. 53° 27′, *A. E. Porsild 33* (O, G), *32* (O); Winter Harbor, *Gardner 114, 216* (G); Battle Harbor, *Gardner 62* (pt.), *99* (G); same, *Abbe 234* (O, G); same, *Townsend 19* (G); same, *Bishop 242* (G); same, *Waghorne 4* (A); same, *M. T. Doutt 3033* (C); Cartridge Bay and Seal Islands, *Waghorne 13* (pt.) (O); Long Tickle, *Townsend 32;* Holton, *Waghorne 69* (A); W. branch of Hamilton R., *Low 6050* (O); Grand Falls, Hamilton R., *M. T. Doutt 3372, 3375* (C); L. Petitsikepau, *Low 6049* (O).—S. QUEBEC & NEWFOUNDLAND: Boat Harbor, Nfld., *Fernald, Wiegand & Long 27965* (G); Flower Cove, Nfld., *Fernald, Long & Dunbar 26579, 26580* (G); same, *Fernald, Griscom & Gilbert 27956* (G); same, *A. G. Huntsman Sept. 2, 1923* (G); Archipel du Petit Mecatina, *St. John 90843, 90844* (O, G); Pte. du Sud-ouest, Anticosti, *Victorin & Rolland 27769* (O, G); same, *John Macoun 18818* (O).

11. **Salix hudsonensis** Schneider in Bot. Gaz. **67**: 57 (1919), in Jour. Arn. Arb. **3**: 69 (1921); Polunin in Nat. Mus. Can. Bull. **92**: 161 (1940).—*S. fullertonensis* × *groenlandica* Schneider in Bot. Gaz. **66**: 342 (1918).

Apparently confined to the Hudson and James Bay regions and the central arctic coast. It has been collected most commonly about the north and northwest shores of Hudson Bay. As indicated above, Schneider first designated this group of plants as hybrids of *S. arctophila* (*S. groenlandica*) and his newly described *S. fullertonensis*. Later he saw more material, notably the Preble specimens cited below, and decided to set up a new species to cover the lot. He

considered it most nearly related to *S. arctica* var. *Brownei* (*S. anglorum*) and *S. arctophila,* particularly to the latter, from which it differs in its shorter pedicels and more elongated glands. I have had no experience with it in the field, but Polunin (l. c.) says that he has continually failed to recognize it while collecting, even though he has found it amply represented in his collections. Like Polunin, therefore, I am retaining it as a separate species with hesitation, in view of its lack of distinctness in the field and of its apparent "intermediate" nature. Its proper designation must await the accumulation of more specimens and field notes (see note under *S. fullertonensis*).

SPECIMENS EXAMINED: KEEWATIN: Roes Welcome, S. of Wager Bay, *Freuchen 691* (O) (see note under *S. fullertonensis*); Fullerton, *J. M. Macoun 79148* (O), *79167* (O, N, G); Chesterfield Inlet, *Malte 120466, 120492* (O, N), *120483, 120486, 120517, 120543* (O); same, *Polunin 2146* (G), *2199* (O); ? Rankin Inlet, *J. M. Macoun 79162* (G); 50 mi. S. of Cape Eskimo, *Preble & Preble 43* (TYPE), *46* (A, photos).—ONTARIO: Barren shores of Hudson Bay, lat. 55–56°, *J. M. Macoun 18822* (O); mouth of Albany R., James Bay, *Spreadborough 62618* (O, A, photo).

Since this species is commonly unrecognized by collectors and needs much further study, it is worth while to mention a few other specimens that have been cited. Schneider gives the following[20]: 25 mi. S. of Cape Eskimo, *Preble & Preble 54, 57* (W); Nottingham I., *R. Bell 54358* (O); Digges I., *R. Bell 54359* (O); Mansfield I., *R. Bell 54360* (O); Katur Pt., Bathurst Inlet, *R. M. Anderson 93775* (O). Polunin cites: South Bay, Southampton I., *Malte 120687* (O, N); Wolstenholm, *Polunin 1934;* Whale Pt., *Comer 1893* (K); ? Chesterfield, *Freuchen 733* (C) (under *reptans* in Grøntved, Rept. 5th Thule Exp. 2: 34).

12. **Salix glauca** L., Sp. Pl. **2**: 1019 (1753); Macoun, J., Cat. Can. Pl. 1[3]: 448 (1886), in part; Macoun, J. M. in Geol. Surv. Can. **1887–88**: 70J (1889), in part, **1895**: 362L (1897), in part, **1898**: 36M (1901), in part; Størmer in Nyt. Mag. f. Naturv. **32**: 266 (1933), in part; Polunin in Nat. Mus. Can. Bull. **92**: 162 (1940), in part.—*S. glauca* L. var. *glabrescens* (Anderss.) Schneider in Bot. Gaz. **66**: 329 (1918), in Jour. Arn. Arb. **3**: 69 (1921), in part.

It is unnecessary to review the evidence for the existence, in America, of the true *S. glauca* (see Raup in Rhod. 33: 241, 1931; and Polunin, l. c.). Although Schneider did not admit its presence here and Rydberg gave it a very limited and sporadic occurrence, Coville (in Proc. Wash. Acad. Sci. 3: 321, 1901) found it well represented in Alaska. In 1931 I pointed out (l. c.) that much material from the subarctic parts of the northern Great Plains, variable though it is, cannot be separated from the also variable European *glauca,* and that it matches a great deal of the northern Cordilleran material designated by Schneider as var. *glabrescens.* Since then Polunin (l. c.) has included a few specimens from the Eastern Arctic in *S. glauca,* stating that he has also noted some from "slightly to the south" of his area. Polunin's concept of *S. glauca,* as he applied it in the Eastern Arctic, however, is a very broad one, apparently including var. *acutifolia* as it was interpreted by Schneider, as well as the latter's var. *glabrescens.*

Judging by the collections that I have seen, *S. glauca* is represented in our region most frequently by var. *acutifolia* (Hook.) Schneider. Nevertheless, a few specimens from the eastern coast of Hudson Bay and from James Bay,

[20] The herbaria indicated by Schneider and Polunin in these citations are as follows: W—United States National Herbarium; K—Herbarium of the Royal Botanic Gardens, Kew; C—Botanical Museum, Copenhagen; others as in the present paper.

notably those collected by Dr. & Mrs. Abbe and J. Marr, have the obovate-oblanceolate obtuse leaves of typical *S. glauca* and closely resemble those I have collected in the Mackenzie basin. In addition to these forms, Polunin has erected a var. *stenolepis* for certain plants from southern Baffin and Southampton Island (see below).

Willows representing the typical *S. glauca* of northern Europe, and others of "*glauca*-like" nature, are so common and wide-ranging in boreal America that it will be useful to review briefly the whole series in order to "place" the region with which this paper deals (cf. Raup in Bot. Rev. **7**: 175–177, 1941). Typical or near-typical *S. glauca* occurs chiefly in western arctic and subarctic Canada, Alaska, and the northern Cordillera. On the basis of leaf shape and pubescence it can be divided into varieties with moderately well-defined ranges: vars. *acutifolia, poliophylla, ovalifolia,* and *glabrescens* (the last in Schneider's sense only in part). *Salix desertorum* Rich., a plant of somewhat doubtful status, probably also belongs with these near-typical forms (cf. Raup in Rhod. **33**: 242). I have already noted the occasional appearance of such forms in the Eastern Arctic, and it should be noted that the Abbe and Todd collections from the east coast of Hudson Bay appear to extend the range of *S. glauca* in the more strict sense somewhat to the eastward.

In the Eastern Arctic and on the northeastern mountains is a large group of forms that has been set off as *Salix cordifolia* Pursh. These plants look very much like *glauca* and were not segregated from it specifically by many earlier students of American willows. They are usually low or depressed shrubs with leaves shorter and broader than those of *S. glauca,* even to heart-shaped. Several varieties have been defined in this complex (cf. Fernald in Rhod. **28**: 181, 1926): vars. *typica, callicarpaea, intonsa, Macounii, eucycla, tonsa* (see below). Most of these are based on differences of leaf shape, size, and pubescence, and some have a certain amount of geographic significance. *Salix cordifolia,* s. l., is the commonest representative of the *glauca* group in our region, and in many sections it is the only one. Another short-leaved form in Greenland was described by Schneider as *S. anamesa* (in Bot. Gaz. **66**: 348). *Salix cordifolia* can be reported only doubtfully on the west side of Hudson Bay. Specimens from just west of Chesterfield Inlet (*Tyrrell 1711*) and from Churchill (*Gardner 12, 13, 27, 28*) strongly suggest *cordifolia* var. *callicarpaea,* but I think they are better placed with *glauca* var. *acutifolia.*

A third series is recognized chiefly in the Rocky Mountains, though representatives of it extend eastward to Hudson Bay and reappear in Gaspé and on Anticosti. It appears to contain two complexes that are recognized as species, *S. brachycarpa* Nutt. and *S. pseudolapponum* von Seemen, the former with several varieties. Both of these are distinguished chiefly by their short aments (short-oblong to spherical).

Another group, though scattered geographically, is all arctic or subarctic and has a tendency to short or obsolete petioles. These are *S. chlorolepis* Fernald of the Gaspé region (also distinguished by its glabrous capsules), *S. fullertonensis* Schneider of the northern Hudson Bay region and the central arctic coast, and *S. niphoclada* Rydberg and *S. lingulata* Anderss. of the Western Arctic.

A fifth segregate is *S. MacCalliana* Rowlee (cf. Schneider in Jour. Arn. Arb. **2**: 89, 1920). It shows the widest divergence from typical *S. glauca,* growing into a tall shrub with smooth, rather leathery, distinctly dentate leaves. Its aments closely resemble those of *S. glauca.*

From the above notes and from maps given elsewhere in this paper it is seen at once that the Hudson Bay region is a meeting ground for eastern and western American representatives of the *glauca* group. From the west come *S. glauca* proper, including at least two of its variants, and *S. brachycarpa* with one of its varietal segregates. From the east comes *S. cordifolia,* represented by at least four variants. Needless to say, there is an abundance of intermediate forms in this region, many of which defy a rational classification. Polunin (l. c., p. 163) has already noted this for areas where *S. glauca* and *S. cordifolia* var. *callicarpaea* occur together; and the same may be said of more southern districts where *S. brachycarpa* must be taken into consideration. The relationship of *S. fullertonensis* to the general mêlée is not clear, since this species is itself not yet well known. Many of the citations of specimens given here must therefore be regarded as tentative, and the determinations must remain so until we have a far better understanding than we now have of the nature of the variations involved.

The following key separates the varieties of *S. glauca* as they are here recognized.

Leaves usually obtuse or rounded at the apex, elliptic to obovate or obovate-oblong, silky-pubescent when young and often rather tardily glabrate, entire .....12. *S. glauca.*
Leaves usually more acute at the apex, sometimes subacuminate, the margin often slightly and irregularly glandular-denticulate, both surfaces glabrous or commonly soon glabrate.
Stipules half-cordate-lanceolate .....12a. *S. glauca* var. *acutifolia.*
Stipules narrowly lanceolate .....12b. *S. glauca* var. *stenolepis.*

I regard the following as fairly representative of typical *Salix glauca* as we know it in northwestern America.

Specimens examined: Ontario: The Beacon, mouth of Moose R., *Spreadborough 62620(2)* (O).—N. Quebec: island near mouth of Seal R., Cape Jones, *Abbe & Marr 4144* (M, G).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3155, 3156* (M, G); Beach Cr., *Marr 3272, 4348* (M, G); Cairn I., *Todd July 31, 1926* (C); same, *Abbe & Marr 3035, 3037, 3038, 3039* (M, G); Wiachewan R., *E. C. & L. B. Abbe 3402* (M, G).—Port Harrison, *Todd June 25, 1930* (C).

12a. **Salix glauca** var. **acutifolia** (Hook.) Schneider in Bot. Gaz. **66:** 327 (1918), **67:** 60 (1919), in Jour. Arn. Arb. **3:** 69 (1921).—*S. glauca* L., Macoun, J., Cat. Can. Pl. 1[3]: 448 (1886), in part; Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889), **1895:** 362L (1897), in part, **1898:** 36M (1901), in part; ? Størmer in Nyt. Mag. f. Naturv. **32:** 266 (1933), in part; Polunin in Nat. Mus. Can. Bull. **92:** 162 (1940), apparently for the most part.—*S. glauca* var. *villosa* Anderss., Tyrrell in Geol. Surv. Can. Ann. Rept. **1896:** 213F (1898).—*S. villosa* Barr. var. *acutifolia* Hook., Fl. Bor.-Am. **2:** 144 (1839).

Specimens examined: Keewatin: ? west of Chesterfield Inlet, *Tyrrell 1711* (O).—Manitoba: Churchill, *J. M. Macoun 79159* (O, A, G); same, *Gardner 13* (A, G), *12, 27, 28* (pt.) (A), *383, 384, 435, 485, 487* (G); same, *Polunin 2025* (N), *2034* (G), *2073* (O).—Ontario: W. coast of Hudson Bay, lat. 56°, *J. M. Macoun 24635* (O).—N. Quebec: 5 mi. S. of Great Whale R., *M. T. Doutt 2528* (C).—Richmond Gulf: *Spreadborough 24510* (O); Cairn I., *Abbe & Marr 3481* (M, G); Wiachewan Bay, *E. C. & L. B. Abbe 3317* (M, G).—Along Ungava R., Aug. 9, 1896, *Spreadborough 13683* (O); 5 mi. S. of West Sugluk, *Malte 127012, 127004* (O); Wakeham Bay, *Malte 120220, 120231, 120233* (O).

12b. **Salix glauca** var. **stenolepis** (Floderus, in herb.) Polunin in Nat. Mus. Can. Bull. **92:** 163 (1940).

This variety was based upon a specimen collected by Malte at Lake Harbor, Baffin Island (*118812,* O). It is distinguished by having narrowly lanceolate stipules 3–6 mm. long, and by narrowly oblong bracts about 3(4) mm. long and less than 1 mm. broad. Polunin states that he has "found other material that matches it, both in southern Baffin and on Southampton Island, as well as a rather similar specimen from Mount McKinley National Park in Alaska. . . ."

He cites a specimen: South Bay, Southampton I., *Polunin,* 1936, and others collected by himself, Malte, and Johansen from Lake Harbor. I have not seen any of these specimens, but one from Lake Harbor collected by Miss Oldenburg, no. *98* (M), shows neither the narrow bracts nor narrow stipules of var. *stenolepis.* It appears to be var. *acutifolia.*

13. **Salix cordifolia** Pursh, Fl. Am. Sept. **2:** 611 (1814).

Schneider's treatment of this common and highly variable group of willows is far from satisfactory. He had only limited material, for many of the more extensive collections by Professor Fernald and his co-workers had not yet been made; furthermore, Schneider's unavoidable lack of field experience with the plants greatly hindered his understanding of them. In 1926, after two seasons' collecting in Newfoundland, Fernald published a revision of the group which has at least reduced it to some semblance of order. In the ensuing treatment I have followed Fernald's arrangement rather closely.

Salix cordifolia, s. l., although abundant throughout the eastern part of our area, is apparently rare or nonexistent on the west coast of Hudson Bay. It has been obtained from nearly all collection localities on the Labrador Peninsula, extending south to the southern end of James Bay, and west along the north shore of the Gulf of St. Lawrence to the Mingan Islands and Anticosti. It is also common in northwestern Newfoundland and on the mountains of the Gaspé Peninsula. Polunin says that it extends northward on Baffin Island to the Arctic Circle. The following is a key to the varieties, taken directly from Fernald's revision (Rhod. **28:** 182, 1926).

New branchlets and young leaves more or less densely villous or sericeous.
  Leaves of fruiting branches oval to ovate or obovate, cordate to rounded at the base, mostly 3–7 cm. long .....13a. *S. cordifolia* var. *typica.*
  Leaves of fruiting branches not cordate, if rounded at the base mostly smaller or narrower.
    Mature leaves mostly 2.5–6 cm. long, oblanceolate, oblong, elliptic or narrowly obovate.
      Leaves glabrate in maturity or merely a little silky on the nerves beneath.
        13b. *S. cordifolia* var. *callicarpaea.*
      Leaves permanently and rather densely villous .....13d. *S. cordifolia* var. *intonsa.*
    Mature leaves mostly only 1–2.5 cm. long, orbicular to short-oblong or narrowly obovate.
      Leaves elliptic, oblong or narrowly obovate, acute or acutish.
        13c. *S. cordifolia* var. *Macounii.*
      Leaves orbicular to short-oblong, rounded at the summit.
        13f. *S. cordifolia* var. *eucycla.*
New branchlets and young leaves glabrous or essentially so; leaves obovate, 2–5 cm. broad.
  13e. *S. cordifolia* var. *tonsa.*

13a. **Salix cordifolia** var. **typica** Fernald in Rhod. **28:** 182 (1926); Schneider in Bot. Gaz. **66:** 343 (1918), in Jour. Arn. Arb. **3:** 70 (1921), in part; Abbe in Rhod. **38:** 147 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 164 (1940).—*S. labradorica* Rydberg in Bull. N. Y. Bot. Gard. **1:** 270 (1899), as to Labrador plant.—*S. glauca* L., of earlier Amer. auth., in part.

The typical form, marked by having leaves rounded to cordate at base, is apparently occasional throughout much of the over-all range of the species, although it does not seem to reach quite so far north or south as do the other varieties.

Specimens examined: N. Quebec: Belcher Isls.: Tukarak I., *J. K. Doutt 123* (C); Flaherty I., *Abbe & Marr 4103* (M, G).—Smith I., *Malte 120908* (O); Port Harrison, *Malte 120764* (O); Wakeham Bay, *Malte 118658* (O).—Labrador: Seven Islands Bay, Kangalaksiorvik, *Abbe 230* (O, G); Nachvak, *R. Bell 18819, 18821* (O); Battle Harbor, *Gardner July 13, 1933* (G); Henley Harbor, *A. G. Huntsman Aug. 15, 1923* (G); same, *Aug. 21, 1923* (G).—S. Quebec and Newfoundland: Greenly I., *Lewis 130706* (O); Lake

I., *Lewis 130711, 130712* (O); Ile Moutange, Mingan Isls., *Victorin & Rolland 21686* (G); Highlands of St. John, Nfld., *Fernald & Long 27978* (G); Ingornachoix Bay, Nfld., *Fernald & Wiegand 3219* (G).

13b. **Salix cordifolia** var. **callicarpaea** (Trautv.) Fernald in Rhod. **28:** 184 (1926); Lewis in Can. Field Nat. **45:** 227 (1931); Potter in Rhod. **36:** 279 (1934); Abbe in Rhod. **38:** 147 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 165 (1940).—*S. callicarpaea* Trautv. in Nouv. Mém. Soc. Imp. Nat. Mosc. **2:** 295, *t. 7* (1832).—*S. atra* Rydberg in Bull. N. Y. Bot. Gard. **1:** 272 (1899).—*S. cordifolia* Pursh, Schneider in Bot. Gaz. **66:** 343 (1918), in Jour. Arn. Arb. **3:** 70 (1921), for the most part, also as f. *atra* (Rydberg) Schneider; St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922), in part.—*S. cordifolia* f. *hypoprionota* Schneider in Bot. Gaz. **66:** 346 (1918), as to forms with serrulate-dentate leaves; St. John, l. c., in part.—*S. glauca* L., Rydberg, l. c. 271, as to Labrador plant; and also of earlier Amer. auth.

This is the commonest form of *S. cordifolia* throughout most of the latter's range. It is distinguished by its comparatively large mature leaves (2.5–6 cm. long), which are not cordate.

Specimens examined: Ontario: South Twin I., *M. T. Doutt 2370* (C).—N. Quebec: Brushy I., E. coast of James Bay, *Potter 914* (G); Pt. Comfort, James Bay, *Potter 909* (G); Little Cape Jones, *Sutton July 19, 1926* (C); island near mouth of Seal R., *Abbe & Marr 4142* (M, G); mainland at S. end of Manitounuk Sd., *E. C. & L. B. Abbe 3966* (M, G); island between Boat Opening and Schooner Opening, Manitounuk Sd., *Abbe & Marr 3884* (M, G); 5 mi. from mouth of Great Whale R., *M. T. Doutt 2582* (C); near Great Whale R., *Spreadborough 13683a* (O); Belcher Isls., Tukarak I., *Abbe & Marr 4080, 4082* (M, G); same, *J. K. Doutt 264, 122, 330, 124, 59, 60* (C); Bill of Portland I., *M. T. Doutt 2697* (C).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3461* (M, G); small island N. of Cairn I., *Abbe & Marr 3538, 3540, 3541* (M, G); Wiachewan, *E. C. & L. B. Abbe 3385, 3401* (M, G); Beach Cr., *same colls. 3303* (M, G),—? Nastapoka, *Murie June 16, 1915* (C); Port Harrison, *Todd Aug. 14, 1926* (C); same, *Oldenburg 255A* (pt.) (M); same, *Malte 120755, 120822, 120774, 120812, 120705, 120766, 120767, 120773, 120762, 120701, 120703, 127053* (O), *127040* (G), *127044, 127046, 127049, 127051* (O, G); Gilmore I., lat. 59° 50′, *Dutilly, O'Neill & Duman 87452* (G); Wolstenholm, *Malte 120954* (O); Nottingham I., *R. Bell 24546* (O); Mansfield I., *R. Bell 24622* (O); northern Ungava, *Low 24775* (O); along a river in Ungava, *Low 13687a* (O); 5 mi. S. of W. Sugluk, *Malte 127002* (O), *127006, 127008, 127014* (O, G); W. Sugluk, *Polunin 1548* (O); Sugluk, *Oldenburg 157C* (pt.) (M); Wakeham Bay, *Malte 126917* (O, G), *118620, 120182, 120184, 120213, 120224, 120226, 120228, 120230, 120235, 120255, 120258, 120251, 128230* (O); same, *Polunin 1385* (G); Payne Bay, *Ney & Courtright 2411* (O).—Labrador: head of Main Arm of Ekortiarsuk Bay, *Woodworth 169* (G); head of Ryan's Bay, *Woodworth 168, 170* (G); Razorback Mt., Ryan's Bay, *Woodworth 171½* (O, G); 20 mi. N. of Nachvak, *H. S. Forbes 95* (G); Nachvak, *R. Bell 24288* (O); head of Nachvak Bay, *Woodworth 171* (G); head of N. arm of Saglek Bay, *Woodworth 167* (G); Saglek Bay, *Woodworth 172* (G); same, *Gardner 178* (G); Hebron, *Oldenburg 17, 25* (M); same, *J. D. Soper 122083* (O); same, *Polunin 1001, 1053* (O); same, *Wynne-Edwards 7051, 7052, 7060, 7095* (O); Kikkivitak I., lat. 56° 21′, *Abbe 249* (O, G); Rowsell Harbor, lat. 58° 58′, *Abbe & Odell 244* (O, G); Anatolak, *Sewell 459* (G); Flint I., near Port Manvers, *Bryant 94* (G); Nain, *Bishop 243 A & B* (G); 15 mi. W. of Nain, *H. S. Forbes 96* (G); Hopedale, *Bishop 245* (G); 15 mi. N. E. of Ford Harbor, *Bishop 244* (O, G); Ford Harbor, *R. Bell 24545* (O); Turnavik, *A. E. Porsild 89, 93, 129, 130* (O); Gready I., *Bryant 90, 92, 93* (G); same, *Bishop 246* (O, G); same, *Abbe & Hogg 241* (O, G); same, *Gardner 244, 245* (G); Gready Harbor, *J. D. Soper 111432* (O); Indian Harbor, *Bryant 98, 99* (G); same, *Bishop 247* (G); same, *Wetmore 102923* (O); Cartwright, *Woodworth 173* (G); Salmon Bight, *A. E. Porsild 29, 30, 31* (O); Battle Harbor, *Abbe 240* (O, G); same, *Bishop 248 A & B* (G); same, *Gardner 56, 60, 106* (G); same, *Waghorne 91, 94, 95* (A, photos), *21* (A); same, *Todd July 14, 1920* (C); same, *M. T. Doutt 3032* (C); Seal Islands, *Waghorne 18829* (O); Turner's Head, *Waghorne 50, 51, 86* (A, photos); Pack's Harbor, *Waghorne 18* (A); Red Bay, *Sornborger 7* (G); same, *Bowdoin Coll. Exp. 291* (G); same, *A. G. Huntsman Aug. 23 and Sept. 6, 1923* (G); Big Bight, *Sornborger 4* (G); Dumpling Harbor, *B. P. Mann July 17, 1864* (G); Chateau Bay, *Bowdoin Coll. Exp. 78* (G); Winter Harbor, *Gardner 121* (G); Forteau, *Fernald & Wiegand 3212* (G); Muskrat L., on portage to Grand Falls,

Hamilton R., *M. T. Doutt 3377* (C).—S. Quebec and Newfoundland: Bradore Bay, *Lewis 130707* (O); Blanc Sablon, *Fernald & Wiegand 3223, 3225, 3226* (G); same, *M. T. Doutt 3003* (C); same, *Lewis 130704* (O); Greenly I., *Lewis 130705* (O); Brest, *St. John 90845* (O, G); St. Augustin, *Lewis 130708* (O); St. Mary's Archipelago, Long. 59° 38′, *Abbe 1109, 1115* (G); same, *Lewis 130709, 130710* (O); Oupitagone Archipelago, *St. John 90842* (O, G); Caribou Isls., *Martin 4* (G).—Mingan Isls.: Ile Moutange, *Victorin & Rolland 21688, 21690* (G); Ile Ste. Genevieve, *St. John 90838, 90839, 90840* (O, G); same, *Victorin & Rolland 18910, 21698* (G); same, *Lewis 130713* (O); Ile St. Charles, *Victorin & Rolland 18913, 18916, 18929, 25922* (G); Ile Nue, *same colls. 25188, 25925* (G), *25187* (O); Ile Marteau, *St. John 90835, 90836, 90837, 90846* (O, G); same, *Victorin & Rolland 18924, 18925, 18930* (G); Ile Quin, *same colls. 18911, 18927* (G); Ile a Bouleau, *same colls. 18922* (G); Ile a la Vache Marine, *same colls. 18923, 18926* (G).—Anticosti: Pte. du Sud-ouest, *Victorin & Rolland 27765* (G); Baie St. Claire, *Victorin 4349, 4350, 4351* (G).

13c. **Salix cordifolia** var. **Macounii** (Rydberg) Schneider in Bot. Gaz. **66:** 347 (1918), in Jour. Arn. Arb. **3:** 70 (1921); Fernald in Rhod. **28:** 186 (1926); Lewis in Can. Field Nat. **45:** 228 (1931); Abbe in Rhod. **38:** 148 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 165 (1940).—*S. Macounii* Rydberg in Bull. N. Y. Bot. Gard. **1:** 269 (1899).

This variety extends northward to Hudson Straits (cf. Polunin, l. c.), and southward to western Newfoundland and Gaspé. It is known on the east coast of Hudson Bay and in James Bay, but not on the west coast.

Specimens examined: Ontario: South Twin I., *J. M. Macoun 24513* (O).—N. Quebec: Jones R., Little Cape Jones, *Todd July 17, 1926* (C); northern Ungava, *Low 24769* (O).—Labrador: Valley of the Bryant Lakes, Kangalaksiorvik, *Abbe 246* (G); head of North Arm of Saglek Bay, *Woodworth 166½* (G); Kikkertaksoak, Saglek Bay, *Woodworth 166* (G); Hopedale, *Sornborger 1* (G); Indian Harbor, *Abbe & Hogg 242* (O, G); Red Bay, *A. G. Huntsman Sept. 6, 1923* (G); ? Henley I., *same coll. Sept. 7, 1923* (G); Henley Harbor, *same coll. Aug. 15, 1923* (G).—S. Quebec and Newfoundland: Quirpon Harbor, Nfld., *A. G. Huntsman Sept. 8, 1923* (G); St. Anthony, Nfld., *Abbe 238, 239* (O); Flower Cove, Nfld., *Fernald, Long & Dunbar 26571* (G); same, *Fernald & Long 27990* (G); same, *A. G. Huntsman Sept. 2, 3, 1923* (G); Cape Norman, Nfld., *Wiegand, Griscom & Hotchkiss 27987, 27988* (G); Caribou I., *Martin 2* (G); Eskimo Pt., *C. W. Townsend June, 1909* (G); Wolf Bay, *Lewis 130698, 130699, 130700, 130701* (O); Lake I., Long. 60° 3′, *Abbe 1107, 1119* (G); same, *Lewis 130697* (O).—Mingan Isls.: Ile Nue, *Victorin & Rolland 25182, 25183, 25184, 25932* (G), *25185, 25186* (O, G); Ile Ste. Genevieve, *same colls. 18931* (G); Ile a la Proie, *same colls. 21703* (G); Ile a la Vache Marine, *same colls. 18915, 18932* (G); Ile St. Charles, *same colls. 25300* (O, G).

13d. **Salix cordifolia** var. **intonsa** Fernald in Rhod. **28:** 185 (1926); Lewis in Can. Field Nat. **45:** 228 (1931); Abbe in Rhod. **38:** 147 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 165 (1940).

Variety *intonsa* is a large-leaved form similar to var. *callicarpaea,* but with the leaves permanently villous. Like var. *Macounii,* it turns up occasionally on the Labrador Peninsula, and it has been found on South Twin I. in James Bay. It is also known in southeastern Baffin I. (cf. Polunin, l. c.). Polunin states that var. *intonsa* occurs at Churchill, but I have seen no specimens from the west coast of Hudson Bay. It apparently does not extend west of Wolf Bay on the north shore of the Gulf of St. Lawrence.

Specimens examined: Ontario: South Twin I., James Bay, *M. T. Doutt 2460* (C).—N. Quebec: Port Harrison, *Malte 127031* (O, G).—Labrador: head of Ryan's Bay, *Woodworth 162½, 163* (G); head of Nachvak Bay, *Woodworth 164, 165* (G); same, *Abbe 247* (G); 20 mi. N. of Nakvak, *H. S. Forbes 100* (G); Nachvak, *Brooks 247* (O); Kikkertaksoak, Saglek Bay, *Abbe 248* (O, G); Hebron, *Oldenburg July, 1939* (M); Okkak, *Wynne-Edwards 7495* (O); Makkovik, *Stecker 3* (G); Indian Harbor, *Abbe & Hogg 243* (O, G); Turner's Head, Hamilton Inlet, *Waghorne 36* (G) (cf. citation by Fernald, l. c.); Cartwright, *Malte 119874* (O); Battle I., *Townsend 16* (G).—S. Quebec: Blanc Sablon, *Fernald & Long 28031* (G); Wolf Bay, *Lewis 130703* (O); ? Wapitagun, *Lewis 130702* (O).

13e. **Salix cordifolia** var. **tonsa** Fernald in Rhod. **28:** 187 (1926).—*S. cordifolia* f. *tonsa* (Fernald) Polunin in Nat. Mus. Can. Bull. **92:** 165 (1940).—*S. Waghornei* Rydberg in Bull. N. Y. Bot. Gard. **1:** 271 (1899), as to Waghorne specimen from Red Bay.

Polunin says that "At several points within our area [E. Arctic, south to lat. 60°] there occur specimens that on both twigs and young shoots are so nearly glabrous as to be referable to var. *tonsa* Fernald." Since no geographic range for the form could be defined, he preferred to reduce the variety to formal status. For the present, however, I think it as well to keep the various forms of *S. cordifolia* in one kind of category. To be consistent, one should perhaps reduce them all to forms, since some of the others show scarcely any better geographic segregation than does var. *tonsa*. Until they are better understood genetically, however, they may as well remain as Professor Fernald left them. In the area dealt with in this paper, var. *tonsa* has been collected only on the outer Labrador coast and at the Straits of Belle Isle. It is also known in Newfoundland and Gaspé.

Specimens examined: Labrador: head of Nachvak Bay, *Woodworth 162* (G); Red Bay, *Waghorne 33* (A); Forteau, *Fernald & Wiegand 3213, 3214* (G).

13f. **Salix cordifolia** var. **eucycla** Fernald in Rhod. **28:** 187 (1926).—*S. cordifolia* Pursh, St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922), in part.

This is one of the small-leaved phases of the species, but with the leaves much rounded in form. It has been collected in our region only at the Straits of Belle Isle and on the north shore of the Gulf of St. Lawrence.

Specimens examined: Flower Cove, Nfld., *Wiegand, Pease, Long & Hotchkiss 27982* (G), *27991* (O, G); same, *Fernald, Long & Dunbar 26570* (G); Ile Metchiatik, Archipel Oupitagone, *St. John 90841* (O, G).

14. **Salix brachycarpa** Nutt., N. Amer. Sylva **1:** 69 (1843); Schneider in Bot. Gaz. **66:** 336 (1918), in Jour. Arn. Arb. **3:** 69 (1921); Potter in Rhod. **36:** 279 (1934).—*S. desertorum* Richards., Macoun, J., Cat. Can. Pl. 1[3]: 448 (1886), in part; Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889), in part, **1895:** 361L (1897).

Salix brachycarpa is typically a species of the Rocky Mountains and adjacent plains, but it is represented by plants in the southern parts of the Hudson Bay area, Gaspé, and Anticosti that, as Schneider stated, are inseparable "even as a variety." Much of the material in our area, however, has a tendency toward glabrescent leaves and appears to represent the var. *antimima*.

Leaves grey-pubescent above and whitish silky-villous beneath, except some of the smaller ones which are glabrate above; twigs of the current year more or less densely villous-tomentose ..... 14. *S. brachycarpa*.

Leaves glabrescent when mature, even beneath; twigs of the year glabrescent. 14a. *S. brachycarpa* var. *antimima*.

Specimens examined: The following specimens may be regarded as typical of the species in the strict sense: N. Quebec: Pt. Comfort, James Bay, *Potter 905* (G).—S. Quebec: Anticosti: Pte. du Sud-ouest, *Victorin & Rolland 27764* (G), *27767* (O, G); Riv. Jupiter, *same colls. 24735* (O, G), *24734, 24736, 24737, 24738* (G); Jupiter R., *John Macoun 24460* (O).

14a. **Salix brachycarpa** var. **antimima** (Schneider) Raup in Rhod. **33:** 241 (1931).—*S. chlorolepis* Fernald var. *antimima* Schneider in Bot. Gaz. **66:** 339 (1918), in Jour. Arn. Arb. **3:** 69 (1921).—*S. desertorum* Richards., Macoun, J., Cat. Can. Pl. 1[3]: 448 (1886), in part; Macoun, J. M. in Geol. Surv. Can. **1887–88:** 70J (1889), in part, **1895:** 361L (1897), in part.

There are many intergrading forms between this and the typical species, and it may be that it is not worthy of varietal rank. However, it appears as a common tendency in the northern parts of the range of the species—about Hudson

Bay, in the central part of the Mackenzie basin (cf. Raup, l. c.), and in the northern Rocky Mountains (cf. Raup in Contr. Arn. Arb. **6**: 146, 1934).

SPECIMENS EXAMINED: MANITOBA: Near mouth of Seal R., 40 mi. N. W. of Churchill, *Preble & Preble 41* (A, photo); Churchill, *J. M. Macoun 79156* (O, G), *79156a* (O); same, *Gardner 432* (G); same, *Polunin 44* (O), *1864* (G).—ONTARIO: South Twin I., *M. T. Doutt 2284* (C); ? The Beacon, mouth of Moose R., *Spreadborough 62620(1)* (O); Charlton I., *Potter 907* (G).—N. QUEBEC: Mt. Sherrick, *Potter 904* (G); East Pt., James Bay, *Todd June 27, 1941* (C); 9 mi. S. of East Main, *Potter 906* (G); Long Pt., S. of Akuatuk Bay, E. shore of Hudson Bay, *Todd July 19, 1914* (C); N. of Cape Jones, *Low 63272* (O, N); Port Harrison, *Malte 127026* (N, O, G).

15. **Salix fullertonensis** Schneider in Bot. Gaz. **66**: 340 (1918), in Jour. Arn. Arb. **3**: 69 (1921); Polunin in Nat. Mus. Can. Bull. **92**: 162 (1940).

So far as is known, *S. fullertonensis* is endemic in the northern Hudson Bay region and the central arctic coast. Schneider, apparently correctly, places it in the multiform group centering in *S. glauca*, within which it belongs to a small series (*S. niphoclada, S. chlorolepis, S. lingulata*) distinguished by very short or obsolete petioles. From its closest relatives it is distinguished by its very small leaves and entirely prostrate habit.

SPECIMENS EXAMINED: KEEWATIN: Whale Pt., lat. 64°, *Geo. Comer 54075* (O); Fullerton, *J. M. Macoun 79164* (G, N, TYPE COLL.); same, *L. E. Borden 63043* (O, N); Chesterfield Inlet, *Polunin 2181* (O), *2197* (G); same, *L. T. Burwash 132141, 132142* (O); same, *Malte 120565* (O, N); Rankin Inlet, *J. M. Macoun 79163* (N, A, O), *79165* (O, N), *79166* (O); Cape Eskimo, *J. M. Macoun 79161* (N, G, O).

The following specimens of this rare willow were also cited by Schneider: Arctic Sound, Bathurst Inlet, *R. M. Anderson 93776* (O); ? Mansfield I., *R. Bell 24622* (O). Polunin adds the following: Sugluk, *Polunin*, 1936. He also includes some specimens cited variously by Grøntved in Rept. 5th Thule Exp. **2**: 33 (1936): "Chesterfield, Freuchen 1923 (C) ? 732 as 'S. arctica × pulchra' and 734 as 'S. arctica × reptans,' also 735 as 'S. arctica f.'"

In Grøntved's list of plants collected by the members of the 5th Thule Expedition (l. c.), the willows (determined by the Swedish salicologist, J. Enander) include some names which, if correctly applied, indicate extraordinary range extensions. Most notable of these are *S. reptans* Rupr., *S. Barclayi* Anderss., and *S. stolonifera* Cov. *Salix Barclayi* is not otherwise known east of the Rocky and Mackenzie Mts. It is principally developed in southern Alaska, the eastern Aleutians, and in the northern Rockies and Coast Ranges. *Salix stolonifera* is apparently endemic in the eastern Aleutians, southern and southeastern Alaska, and neighboring British Columbia (cf. Hultén, Fl. Aleut. Isls. 152, 1937). *Salix reptans* is a northern Eurasian species not previously reported in the New World.

I have seen only a few duplicates (in Herb. O) of the specimens cited by Grøntved, but they are all presumably in the Botanical Museum at Copenhagen, where they were seen by Dr. Polunin when he was preparing his Botany of the Canadian Eastern Arctic. For the time being, therefore, I shall defer to his judgment as to what most of these specimens actually represent, merely raising a question in one or two instances. Polunin cites the Chesterfield specimen marked "reptans" (*Freuchen 733*) under *S. hudsonensis* (see above) with no mention of another Freuchen specimen, *691*, from Roes Welcome, S. of Wager Bay. He does not mention the *"? Barclayi"* material from Churchill at all, though some *Barclayi* "hybrids" listed by Grøntved from N. Baffin are disposed of variously. *"Salix stolonifera,"* collected by Freuchen at Danish I., *259B*, is cited under *S. arctica*.

I have seen the Roes Welcome specimen, and find that in addition to the "sterile shoots, 15 cm. high; with fully developed leaves" noted by Grøntved (l. c.), it has some immature female catkins. The Chesterfield material, however, is reported to be a "fine specimen, with fully developed leaves and ripe and opened capsules." There is no indication of the stature of the latter. Freuchen's no. *691* seems to me nearest to *S. hudsonensis*. It closely resembles some of the excellent specimens of this poorly known form secured at Chesterfield Inlet by Malte.

It should be noted here that *S. reptans* Rupr., which was probably well understood by Enander, is a small prostrate species of the *"glauca* group." Its affinity was clearly stated in the original description (Ruprecht in Fl. Samojed. Cisural., in Beitrage z. Pflanzenk. des Russ. Reich. **2**: 54, 1845) and has been reiterated by many subsequent authors. Specimens from Arctic Russia in the Arnold Arboretum herbarium (collected by Enander) also bear this out. It seems not impossible, therefore, that some relative of *S. glauca* might be found in the Freuchen material, perhaps *S. fullertonensis*, in addition to *S. hudsonensis*, whose affinities are with *S. arctophila*.

16. **Salix cordata** Muhl. in Neue Schr. Ges. Naturf. Fr. Berlin **4**: 236, *t. 6, fig. 3* (1803); Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80**: 64C (1881), Cat. Can. Pl. 1[a]: 446 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88**: 70J (1889), **1895**: 361L (1897); Schneider in Jour. Arn. Arb. **2**: 189 (1921), **3**: 72 (1921); St. John in Victoria Mem. Mus. Mem. **126**: 79 (1922); Potter in Rhod. **36**: 279 (1934).

This widespread and variable species of eastern America is known in our region only in the more southern sections—the southern end of James Bay and the north shore of the Gulf of St. Lawrence. See note under *S. lutea*.

Specimens examined: Ontario: Bushy I., Moose R., *Potter 913* (G).—S. Quebec: Riv. St. Augustin, *St. John 90369* (O, G); Natashquan, *Victorin & Rolland 28098* (O, G).

17. **Salix lutea** Nutt., N. Amer. Sylva **1**: 63, *t. 19, fig. upper right* (1843); Schneider in Jour. Arn. Arb. **2**: 191 (1921), **3**: 72 (1921); Potter in Rhod. **36**: 279 (1934).

Known in our region only at the south end of James Bay and along the lower Moose R., but it is to be expected along other streams draining northward into Hudson and James Bays from the forested country. The specimens from Moose Factory collected by Todd and Gardner appear to be intermediate between *S. lutea* and *S. cordata*. They have reddish, pubescent young twigs, but the older ones are yellowish, though not so prominently so as in typical *S. lutea* of the northern Great Plains.

Specimens examined: Ontario: Bushy I., Moose R., *Potter 912* (G); Moose Factory, *Todd June 9, 1941* (C); same, *Gardner 19, 39* (A).

18. **Salix myrtillifolia** Anderss. in Öfv. Svensk. Vet.-Akad. Förh. **15**: 132 (1858), in Proc. Am. Acad. **4**: 74 (1858); Schneider in Jour. Arn. Arb. **2**: 193 (1921), **3**: 72 (1921); Fernald in Rhod. **28**: 190 (1926); Potter in Rhod. **36**: 279 (1934).—*S. Novae-Angliae* Anderss., Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80**: 64C (1881), at least in part.

Known only in the southern parts of our region, though apparently widespread there. Its northern limits appear to be at Churchill (cf. Schneider, l. c.), Richmond Gulf, and the Straits of Belle Isle. A var. *brachypoda* has been distinguished as follows.

Leaves of the same color on both sides or only a little paler beneath ....18. *S. myrtillifolia.*
Leaves glaucous beneath .....18a. *S. myrtillifolia* var. *brachypoda.*

Specimens examined (typical form): Manitoba: Kettle Rapids, Nelson R., *Emerton July 15, 1917* (G).—Ontario: Charlton I., James Bay, *Potter 915* (G).—N. Quebec: Popp's

Pt., mainland S. of Cairn I., Richmond Gulf, *Abbe & Marr 3461A* (M, G).— S. Quebec: Blanc Sablon, *Fernald & Wiegand 3161* (G); Anticosti I.: Riv. au Fusil, *Victorin & Rolland 24731* (G), *27737* (O, G); Havre de la Patate, *same colls. 27734* (G).

18a. **Salix myrtillifolia** var. **brachypoda** Fernald in Rhod. **16:** 172 (1914); Schneider in Jour. Arn. Arb. **2:** 195 (1921), **3:** 73 (1921).

According to Fernald's original diagnosis, this variety is to be distinguished by having its leaves whitened beneath, its bracts black, and its conic-ovoid capsules sessile or subsessile. It appears in our region only on the Newfoundland side of the Straits of Belle Isle.

Specimens examined: Sacred I., Str. of Belle Isle., Nfld., *Fernald & Long 28006* (G); Doctor Hill, Highlands of St. John, *same colls. 28010* (G); Bard Harbor Hill, Highlands of St. John, *same colls. 28009* (G).

There is a record, as previously mentioned, of *S. Barclayi* Anderss. at Churchill, published by Grøntved in Rept. 5th Thule Exp. **2:** 34 (1937). This is marked "?" by Enander, who determined the willows of the collection, and it is based upon a single sterile shoot collected by Birket-Smith (*no. 1062B*). It is extremely doubtful if *S. Barclayi,* a Cordilleran and Alaskan species, is represented at Hudson Bay, and it is not impossible that the Birket-Smith specimen is *S. myrtillifolia,* whose leaves at some stages resemble those of *S. Barclayi.*

19. **Salix glaucophylloides** Fernald in Rhod. **16:** 173 (1914); Schneider in Jour. Arn. Arb. **1:** 156 (1920), **3:** 74 (1921); Lewis in Can. Field Nat. **45:** 227 (1931); Potter in Rhod. **36:** 279 (1934).

The known northern limit for this species is on the east cost of Hudson Bay near the mouth of Great Whale R. It is known also on the north shore of the Gulf of St. Lawrence as far east as Natashquan, at Lake St. John, and in Newfoundland. It has not yet been found on the west coast of Hudson Bay.

Specimens examined: Ontario: Bushy I., Moose R., *Potter 917* (G); West Pt., Moose I., *Gardner 62* (pt.) (A); Charlton I., *Potter 903* (G).—N. Quebec: 5 mi. from mouth of Great Whale R., *M. T. Doutt 2581* (C).—S. Quebec: Natashquan, *Victorin & Rolland 18892* (G); Mingan, *Lewis 130728* (O); Riv. Mingan, *Victorin & Rolland 24801, 24803, 24805* (G); Pte. aux Eskimaux, *same colls. 18921* (G).—Mingan Isls.: *same colls.,* Ile a la Proie, *18933* (G); Ile a Bouleau, *18909* (G).—Anticosti: *same colls.,* Riv. a la Patate, *21700* (G); Riv. McDonald, *21701* (G); R. L'Huile, *27755, 27756* (G); Salt L., *John Macoun 24349, 24564* (O).

20. **Salix adenophylla** Hook., Fl. Bor.-Am. **2:** 146 (1839); Macoun, J., Cat. Can. Pl. **1**[3]: 444 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 361L (1897); Schneider in Jour. Arn. Arb. **1:** 158 (1920), **3:** 74 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922); Potter in Rhod. **36:** 279 (1934); Grøntved in Rept. 5th Thule Exp. **2:** 32 (1936).—See also Fernald in Rhod. **9:** 225 (1907).

Known within our region on the north shore of the Gulf of St. Lawrence, on the shores of James Bay, and on the southwest shore of Hudson Bay. It is reported by Grøntved (l. c.) at Churchill (a sterile specimen collected by Birket-Smith, *no. 1065A*), but I have not had access to the material, which is presumably at Copenhagen. These northern specimens appear to represent *S. adenophylla* in the strict sense, rather than the more southern forms that have been segregated by Fernald as *S. syrticola.* Schneider (l. c.) was unable to maintain this segregation.

Specimens examined: Ontario: Severn R., *J. M. Macoun 2004* (O, A, photo); Cape Henrietta Maria, *Spreadborough 62631* (O, A, photo); Bushy I., Moose R., *Potter 908* (G); The Beacon, mouth of Moose R., *Spreadborough 62630* (O, N); west shore of Moose R., opposite Ships Sand I., *M. T. Doutt 2147* (C).—N. Quebec: East Main, *A. H. D. Ross 24358* (O).—S. Quebec: Natashquan, *Townsend July 24–Aug. 10, 1912* (G).

21. **Salix pyrifolia** Anderss. in Svensk. Vetensk. Handl. **6:** 162, *t. 8, fig. 93* (1867); Schneider in Jour. Arn. Arb. **1:** 168 (1920), **3:** 74 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922); Lewis in Can. Field Nat. **45:** 227 (1931).—*S. balsamifera* Barr., Macoun, J., Cat. Can. Pl. 1^3: 445 (1886); Bebb in Bull. Torr. Bot. Cl. **15:** 121 (1888); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 361L (1897).

Southern in our region, with northern limits on the east coast of James Bay and in the Hamilton River district.

Specimens examined: N. Quebec: "Wood" I., Sheppard Isls., James Bay, *Todd Aug. 4, 1912* (C).—Labrador: Sandwich Bay, *Waghorne 3* (pt.) (A); Hawkes Harbor, E. coast of Labrador, *Agnes M. Ayre Aug., 1935* (G); Northwest River, Hamilton Inlet, *same coll. Aug., 1935* (G); Cartwright, *Malte 119900* (O); Chateau, *J. A. Allen Aug. 8, 1882* (O, G); Niger Sd., lat. 52° 12′, *Dutilly, O'Neill & Duman 7083* (G); Muskrat Falls, Hamilton R., *M. T. Doutt 3124* (C); along portage to Grand Falls, Hamilton R., *same coll. 3294* (C).—S. Quebec & Newfoundland: Mistaken Cove, Str. of Belle Isle, Nfld., *Fernald, Long & Dunbar 26559, 26560* (G); La Tabatiere, *Lewis 130723* (O); Natashquan, *Victorin & Rolland 18918, 18919* (G); same, *St. John 90370* (O, G); same, *Abbe 1114* (G); same, *Lewis 130724, 130725, 130726, 130727* (O).

22. **Salix Richardsonii** Hook., Fl. Bor.-Am. **2:** 147, *t. 182* (1839); Bebb in Bot. Gaz. **14:** 49 (1889); Macoun, J., Cat. Can. Pl. 2^5: 359 (1890); Macoun, J. M. in Can. Rec. Sci. **6:** 151 (1894), at least as to Tyrrell specimen from Chesterfield; Tyrrell in Geol. Surv. Can. Ann. Rept. **1896:** 213F (1898); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1898:** 36M (1901); Schneider in Jour. Arn. Arb. **1:** 214 (1920), **3:** 74 (1921); Størmer in Nyt. Mag. f. Naturv. **32:** 266 (1933); Grøntved in Rept. 5th Thule Exp. **2:** 35 (1936); Raup in Mem. Carn. Mus: 12^3: 22 (1936).—*S. Richardsonii* var. *McKeandii* Polunin in Nat. Mus. Can. Bull. **92:** 167 (1940).—*S. lanata* L., Macoun, J., Cat. Can. Pl. 1^3: 455 (1886), in part.

Salix Richardsonii is a species of the Western Arctic and Alaska, reaching its eastern limits in the northern and northwestern parts of our area. Judging by the small number of collections available, it is not common here, and this is born out by Polunin's observation (l. c., p. 167) that it is "generally only occasional." Polunin regards all of the Hudson Bay and eastern arctic material as a geographic variety distinguished by having its mature leaves much smaller (1–3(4) cm. long and 4–13(15) mm. broad) than in the typical form, and by usually having short, densely pilose pedicels on the capsules. This plant he named var. *McKeandii* (l. c.). In the original description of *S. Richardsonii,* drawn from material collected by Richardson at Fort Franklin in the Great Bear Lake region, no mention is made of the size of the leaves or of the presence or absence of pedicels. However, Hooker's plate shows habit sketches, presumably natural-size, of sterile and fruiting branchlets, both having leaves somewhat larger than those described for var. *McKeandii.* I have seen parts of the original Richardson material at the herbaria of the New York Botanical Garden and Harvard, all of which show the same tendency to larger leaves. Also, I have collected typical *S. Richardsonii* in the Mackenzie Mountains, where it is abundant. Coville's description of the leaves (in Proc. Wash. Acad. Sci. **3:** 315, 1901) as "3 to 6 cm. long at maturity" in the typical species is approximately correct, although some of the leaves on a sterile branchlet of the Richardson collection at the Gray Herbarium are less than 3 cm. long. With regard to the pedicels, Hooker's plate shows them nearly or entirely lacking, and such western material as I have seen bears this out.

There is in the National Herbarium of Canada a specimen collected by J. W. Tyrrell at Chesterfield Inlet on Sept. 11, 1893. On this day, the Tyrrell party was very near the mouth of the Inlet, which they reached on the 12th. The

specimen, *no. 1762,* is a short fruiting branchlet with the capsules breaking open and the leaves well-developed. In all respects (larger leaves, sessile capsules) it is a match for the typical species. In fact, it so closely resembles the habit sketch of a fruiting twig in Hooker's plate that the latter could well have been drawn from it. This must have been noted long ago by Rydberg, who wrote "typical" on the herbarium sheet. Polunin's statement that all the eastern arctic material is var. *McKeandii* must therefore be revised to allow the typical species on the northwest coast of Hudson Bay.

The nearest relative of *S. Richardsonii* is *S. calcicola,* which is common in the eastern and central parts of our region (see below). This eastern species differs in having shorter, more rounded leaves, oblong-ovate to suborbicular stipules, and undivided stigmas. It was described by Bebb, as *S. Richardsonii* var. *Macouniana,* from plants collected on South Twin Island, James Bay, and a plate published with the original description (Bot. Gaz. **14:** *pl. 9*) shows a short-pediceled capsule, with the pedicel hairy. Examination of a large series of specimens shows this last character to be rather consistent, although nothing was said of it either by Bebb or by Fernald and Wiegand, who set up *S. calcicola* as a separate species (Rhod. **13:** 251). Polunin (l. c., p. 169) cites several specimens from central and southern Baffin Island, and from the districts about Hudson Strait, as intermediates between *S. calicicola* and his var. *McKeandii* of *S. Richardsonii.* He says these intermediates are somewhat more common than his variety, and suggests that some of them may be direct hybrids.

I have not seen the type of var. *McKeandii,* but I think it should be noted that the points by which it differs from typical *Richardsonii* are those which would relate it to *S. calcicola,* i.e., shorter leaves and hairy-pediceled capsules. Polunin says nothing about the shape of the leaves of his variety, but his plate (l. c., p. 168) shows that they tend to be rounded at the base rather than tapering as in typical *Richardsonii.* This also is in the direction of *S. calcicola.* On the other hand, Polunin's plate shows divided stigmas which are characteristic of *Richardsonii.*

Thus it seems that var. *McKeandii* should be considered as nothing more than another phase of the population of intermediates between *S. Richardsonii* and *S. calcicola.* The nature of these intermediates, as in the case of other willow groups such as *arctica* and *glauca* and their allies, will remain uncertain until much more study has been made of their genetic behavior.

The following specimens, aside from the Tyrrell plant discussed above, represent such of the intermediate group as I have seen that closely resemble *S. Richardsonii.*

Specimens examined: Keewatin: Southampton Isl., *Sutton June 26, Aug. 3, 1929–30* (C); same, *Oldenburg 188D* (M); same, *Malte 120576, 120597, 120691* (N); Chesterfield Inlet, *Tyrrell 1762* (O).

In addition to these we have a record of *S. Richardsonii* at Churchill, based upon collections made by Frits Johansen in 1929 (cf. Størmer, l. c.). I have not seen this material, and in view of the rather close relationships within the group of *S. Richardsonii* and *S. calcicola* I prefer to leave it as uncertain.

23. **Salix calcicola** Fernald & Wiegand in Rhod. **13:** 251 (1911); Schneider in Jour. Arn. Arb. **1:** 215 (1920), **3:** 74 (1921); Fernald in Rhod. **28:** 190 (1926); Abbe in Rhod. **38:** 148 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 169 (1940).—*S. lanata* L., Macoun, J., Cat. Can. Pl. 1^3: 455 (1886), in part.—*S. lanata* L. var. *Macouniana* Bebb, acc. to Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889),

nomen nudum.—*S. Richardsonii* Hook. var. *Macouniana* Bebb in Bot. Gaz. **14:** 50 (1889); Macoun, J., Cat. Can. Pl. 2^5: 359 (1890); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 362L (1897).

Apparently common in the northern part of the Labrador Peninsula, extending northward at least to the Arctic Circle (cf. Polunin, l. c.). On the outer Labrador coast it has been collected as far south as the Mugford Peninsula, and it reappears in northwestern Newfoundland at the Straits of Belle Isle. In Hudson Bay it is common on the eastern coast south to South Twin Island in James Bay (the type locality of *S. Richardsonii* var. *Macouniana* Bebb). It appears to be sporadic on the west coast and has been collected only at Churchill and Cape Eskimo.

As noted in the discussion of *S. Richardsonii,* there are many forms that are transitional between these two species, particularly in the northern part of the Hudson Bay area. Nevertheless, in the eastern part of its range, *S. calcicola* is a distinct entity that is easily separated from its western relative. Polunin has described a var. *Nicholsiana,* which is distinguished by the following characters. It has been found only on Southampton Island.

Stipules densely glandular-denticulate; leaves usually short-ovate to orbicular-apiculate, rounded at the base or subcordate .....23. *S. calcicola.*
Stipules entire except for occasional glands toward the base; leaves obovate, tapering toward the base .....23a. *S. calcicola* var. *Nicholsiana.*

Specimens examined (typical form): Keewatin: Cape Eskimo, *Gardner 408* (G).—Manitoba: Churchill, *J. M. Macoun 79154* (O, G); same, *Gardner 72* (A, O).—Ontario: S. Twin I., James Bay, *J. M. Macoun 24625* (O, Type of *Richardsonii* var. *Macouniana* Bebb; A, photo); same, *M. T. Doutt 2265* (C).—N. Quebec: Long Pt., south of Akuatuk Bay, *Todd July 19, 1914* (C); Great Whale R., along coast of Hudson Bay, *Spreadborough 62015* (O); Belcher Isls. (Tukarak I.), *J. K. Doutt 1* (C); mainland at S. end of Manitounuk Sd., *E. C. & L. B. Abbe 3967* (M, G); S. side of Gulf Hazard, Richmond Gulf, *E. C. & L. B. Abbe 3846* (M, G); Nastapoka R., *Murie May 17, 1915* (C); Port Harrison, *Todd May 30, 1930* (C); same, *Malte 127027, 127029, 127042* (O, G), *120757, 120769, 127038* (O); same, *Polunin 1574* (O); same, *Oldenburg 230B, 255A* (pt.) (M); Kovik R., E. shore of Hudson Bay, lat. 61° 59′, *Low 23038* (O); along Ungava R., *Aug. 23, 1896, Spreadborough 13697* (O); Smith I., *Malte 120890* (O); Sugluk, *Oldenburg 157C* (pt.) (M); Wakeham Bay, *Malte 126905, 126909* (O, G), *120217, 120225, 120281* (O); Payne Bay, *Ney & Courtright 1823* (G), *2424* (O); Port Burwell, *L. E. Borden 63044* (O, A, photo), *63045* (O); same, *J. M. Macoun 79155* (O, G); same, *Malte 126818, 126821, 126824, 126831, 126833, 126838* (O, G), *120021* (O).—Labrador: head of Ryan's Bay, *Woodworth 174* (G); Kangalaksiorvik, *Bryant 75* (G); same, *Abbe 252* (O, G); Nachvak, *R. Bell 24739* (O); Rowsell Harbor, lat. 58° 58′, *Abbe & Odell 251* (G); Cape Mugford Peninsula, lat. 57° 50′, *Abbe 250* (G).—N. W. Newfoundland: Sandy Cove, Str. of Belle Isle, *Fernald, Long & Dunbar 26564* (G); Big Brook, Str. of Belle Isle, *Wiegand, Gilbert & Hotchkiss 28015* (G).

23a. **Salix calcicola** var. **Nicholsiana** Polunin in Jour. Bot. **76:** 98 (1938), in Nat. Mus. Can. Bull. **92:** 170 (1940).

Specimens examined: Keewatin: Southampton I., *Oldenburg 188A* (M).

24. **Salix Wiegandii** Fernald in Rhod. **35:** 243 (1933).

Apparently endemic in northwestern Newfoundland, where, according to Fernald, it grows characteristically on limestone barrens. Although not actually noted from the Straits of Belle Isle, it is included here on account of its occurrence in the vicinity, on terrain similar to that at the Straits.

Specimens examined: Gargamelle Cove, Ingornachoix Bay, *Fernald, Long & Fogg 1602* (G, type); Ingornachoix Bay, *Fernald, Wiegand & Kittredge 3185* (G); old Port au Choix, St. John Bay, *Fernald, Long & Fogg 1603, 1604* (G); Pte. Riche, *Fernald, Long & Fogg 1605* (G).

25. **Salix alaxensis** (Anderss.) Cov. var. **obovalifolia** Ball in Jour. Wash. Acad. Sci. **28:** 443 (1938).—*S. alaxensis* (Anderss.) Cov. in Proc. Wash. Acad. Sci. **2:** 280 (1900), **3:** 311, *t. 24* (1901), in part; Schneider in Jour. Arn. Arb. **1:** 223 (1920), **3:** 75 (1921), in part; Raup in Mem. Carn. Mus. **12**[3]**:** 22 (1936); Polunin in Nat. Mus. Can. Bull. **92:** 171 (1940).—*S. speciosa* Hook. & Arn., Tyrrell in Geol. Surv. Can. Ann. Rept. **1896:** 213F (1898); Grøntved in Rept. 5th Thule Exp. **2:** 35 (1936).

Salix alaxensis is represented in our region only about the northwest coasts of Hudson Bay and westward in Keewatin. It is characteristically a species of Mackenzie, Yukon, Alaska, and the northern Rockies, and finds its eastern limit in our region. All of the material I have seen from Hudson Bay appears to have the broader, obovate leaves and dilated clasping petioles of the recently defined var. *obovalifolia.*

Specimens examined: Franklin: Vansittart I., Georgina I., *Freuchen 23* (O).—Keewatin: South Bay, Southampton I., *Sutton June 30, July 23, 1929–30* (C); Chesterfield Inlet, *Tyrrell 1765* (O); same, *Malte 120516* (O, N); same, *Dutilly 601, 6704* (G); same, *Polunin 2149* (G); same, *Gardner 333, 342* (G); Baker L., *Helge Bangsted 1100* (O).

26. **Salix laurentiana** Fernald in Rhod. **9:** 221 (1907); Schneider in Jour. Arn. Arb. **1:** 222 (1920), **3:** 74 (1921).

This species was originally described from plants collected on the Gaspé Peninsula and has since been found in the Mingan Islands and vicinity. Schneider cited a specimen, which I have not seen, from Blanc Sablon at the Straits of Belle Isle. It was collected by Waghorne (*no. 1,* part, *July 27, 1893,* U. S. Nat. Herb.) and was mixed on a sheet with *S. planifolia.*

Specimens examined: Mingan Islands: Ile du Havre du Mingan, *Victorin & Rolland 18908* (G); Ile au Marteau, *same colls. 18917* (G).—Magpie, *same colls. 18885* (G).

27. **Salix candida** Flügge, apud Willd., Sp. Pl. **4:** 708 (1805); Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80:** 64C (1881), Cat. Can. Pl. **1**[3]**:** 446 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889), **1895:** 361L (1897); Schneider in Jour. Arn. Arb. **1:** 226 (1920), **3:** 75 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922); Lewis in Can. Field Nat. **45:** 227 (1931); Størmer in Nyt. Mag. f. Naturv. **32:** 266 (1933); Potter in Rhod. **36:** 279 (1934).

A common muskeg shrub of the more southern parts of our area. Its known northern limits are at Churchill, Richmond Gulf, and Sandwich Bay. For the most part it is rather uniform, but glabrescent-leaved forms occur which are called var. *denudata* Anderss., as follows.

Leaves, even when mature, densely subfloccose- or subfarinaceous-tomentose.
27. S. candida.
Leaves glabrescent or almost glabrous when mature .....27a. *S. candida* var. *denudata.*

Specimens examined (typical form): Manitoba: Churchill, *J. M. Macoun 79144* (O, G); same, *Polunin 2013* (G).—Ontario: W. shore of Moose R., opposite Ships Sand I., *M. T. Doutt 2148* (C); Charlton I., *Potter 896* (G); S. part of James Bay, *W. J. Wilson 53970* (O).—N. Quebec: Brushy I., E. coast of James Bay, *Potter 897* (G); East Main, *Potter 898* (G); Bay of Ft. George, *Dutilly, O'Neill & Duman 97300* (G).—Richmond Gulf: mainland S. of Cairn I., *Abbe & Marr 3163* (M, G); Kangetschoo, *Abbe & Marr 3548* (M, G); Cairn I., *Abbe & Marr 3009, 3010, 3045, 3046, 3096, 3097* (M, G).—L. Mistassini, *J. M. Macoun 24303* (O).—Labrador: Sandwich Bay, *A. P. Brown Aug., 1902* (G); Forteau, *Waghorne 13* (pt.) (A); same, *J. A. Allen July 31, 1882* (G); same, *Fernald & Wiegand 3189* (G).—S. Quebec & Newfoundland: Flower Cove, *A. G. Huntsman Sept. 2, 1923* (G); Blanc Sablon, *Fernald & Wiegand 3180* (G); Brest, *St. John 90371* (O, G); Bradore Bay, *Lewis 130719, 130720, 130721* (O).—Mingan Isls.: Ile Nue, *Victorin & Rolland 24795* (G); Ile Quin, *same colls. 18907* (G); Ile Ste. Genevieve, *same colls. 18904, 18905* (G); Ile a Marteau, *same colls. 18903* (G); Ile a la Proie, *same colls. 21684, 21689, 21709* (G); Ile a la Chasse, *same colls. 18906, 24786* (G), *24733, 24785* (O, G); same, *St. John 90372* (O, G); Pte. aux Morts, *Victorin & Rolland 18902* (G); Ile St. Charles, *same colls. 24799* (G).—Tete-a-Perdrix, *Victorin & Rolland 24739* (G); Baie Johan Beetz,

Lewis 130722 (O); Betchewun, *Abbe 1112* (G); Eskimo Pt., *C. W. Townsend June, 1909* (G); Sugarloaf I., long. 64° 4′, *Abbe 1117* (G).—Anticosti: *Pursh* (G); Sand Top, *Victorin & Rolland 21704* (G); Pte. de l'Est, *same colls. 21691, 21705* (G); Riv. au Fusil, *same colls. 24789, 24790, 27735* (G); Baie Ellis, *same colls. 27736* (G); Riv. des Caps, *same colls. 27731* (O, G); Cap Ste. Claire, *Victorin 4347* (G); Baie Ste. Claire, *Victorin 4348* (G); Salt L., *John Macoun 100616* (O).

27a. **Salix candida** var. **denudata** Anderss., DC. Prod. 16²: 278 (1868); Schneider in Jour. Arn. Arb. **1**: 227 (1920), **3**: 75 (1921); Lewis in Can. Field Nat. **45**: 227 (1931); Potter in Rhod. **36**: 279 (1934).

This variety has been collected in our area only on Anticosti and the North Shore, at the Straits of Belle Isle, and at the southern end of James Bay. Needless to say, there are plenty of intermediates between it and the typical species.

Specimens examined: Ontario: Bushy I., Moose R., *Potter 899* (G); Saw Pit I., Moose R., *Potter 893* (G); Bay W. of Pt. Comfort, *Potter 891* (G).—S. Quebec & Newfoundland: Eddies Cove Brook, Str. of Belle Isle, Nfld., *Fernald, Wiegand & Long 28024* (G); Betchewun, *Lewis 130718* (O); Pte. du Sud-ouest, Anticosti, *Victorin & Rolland 27766* (O, G).

28. **Salix cryptodonta** Fernald in Rhod. **16**: 172 (1914); Schneider in Jour. Arn. Arb. **1**: 226 (1920), **3**: 75 (1921); Fernald in Rhod. **28**: 190 (1926).

Known only in the extreme southeastern part of our area, and there only from a small number of collections.

Specimens examined: S. Quebec & Newfoundland: Burnt Cape, Pistolet Bay, Nfld., *Fernald & Long 28028* (G); Savage Cove, Str. of Belle Isle, Nfld., *Fernald & Long 28026, 28027* (G); Grande Ile, Mingan Isls., *Victorin & Rolland 21679* (G).

29. **Salix Bebbiana** Sarg. in Garden & Forest **8**: 463 (1895); Schneider in Jour. Arn. Arb. **2**: 66 (1920), **3**: 75 (1921); Potter in Rhod. **36**: 279 (1934).—*S. Bebbiana* var. *perrostrata* (Rydberg) Schneider in Jour. Arn. Arb. **2**: 71 (1920), **3**: 75 (1921); Fernald in Rhod. **28**: 190 (1926); Woodworth in Rhod. **29**: 56 (1927); Lewis in Can. Field Nat. **45**: 227 (1931).—*S. Bebbiana* var. *capreifolia* Fernald in Rhod. **26**: 123 (1924); Schneider in Jour. Arn. Arb. **2**: 72 (1920), **3**: 75 (1921) (as f. *capreifolia*); Lewis in Can. Field Nat. **45**: 227 (1931).—*S. rostrata* Richardson in Bot. App. to Franklin's Narr. Journ. Polar Sea 753 (1823); repr. 25, ed. 2, 765 (1823); Macoun, J., Cat. Can. Pl. 1³: 453 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88**: 70J (1889), **1895**: 362L (1897); ? St. John in Victoria Mem. Mus. Mem. **126**: 78 (1922).

Salix Bebbiana is one of the most widespread willows in the subarctic portions of the continent. In many regions also it is one of the most abundant species, probably due to its ability to thrive in coniferous forest. In our region it is limited to the forested parts, but apparently it does not extend northward to the limit of the timber. Its known northern limits are on the lower Nelson River of northern Manitoba, about the southern end of James Bay, and in the Hamilton Inlet and River districts of Labrador.

It is with considerable hesitation that I have merged with the typical species the two varieties which commonly have been recognized in northeastern America. As Schneider has pointed out, in essential characters of flower, fruit, and fruiting habit there is remarkable uniformity throughout the range of the species from Newfoundland to Alaska. Only the little-known var. *projecta* Fernald, from western Newfoundland, seems to show any notable variation in these respects. On the other hand, the variability of leaf texture, size, shape, venation, and pubescence is notorious throughout the range. The principal variations usually recognized are glabrescent-leaved forms, with leaf surfaces nearly plane instead of somewhat impressed-reticulate above as in the typical species, and heavily pubescent-leaved forms. The first have been called var. *perrostrata,* and the

second var. *capreifolia*. As defined by Schneider, var. *perrostrata* is typically of the western Great Plains and Rocky Mountains of the United States (it was originally described by Rydberg from the Black Hills, Bull. N. Y. Bot. Gard. 2: 163, 1901). He regarded as typical the plants of most of the northern parts of the continent, from Alaska to the St. Lawrence, with the exception of extremely pubescent forms in southeastern Canada, which he regarded as f. *capreifolia*. There are, however, as Schneider emphasized, so many intermediate forms that it becomes practically impossible to separate any large number of specimens into three groups that show any real consistency within themselves. The geographic arrangement given above immediately breaks down if all glabrescent, flat-leaved forms are called var. *perrostrata*, for these turn up throughout the broad northern range of the species. In fact, as Schneider says, if Richardson's Fort Franklin specimens are regarded as the type of *S. rostrata* Rich., then the glabrescent-leaved form would become the typical species, for Richardson's material bears a strong resemblance to var. *perrostrata*.

For the present, therefore, and until we know more about what goes on genetically in this complex of forms, I am keeping them together as one species, even though it is possible to see leaf-form trends that are at least partially segregated geographically.

SPECIMENS EXAMINED: MANITOBA: Gillam, along Hudson Bay Ry., *Gardner 95* (A).—ONTARIO: Severn R., June 25, 1886, *J. M. Macoun 24636* (O); 9-mile Rapid, Abitibi R., *Potter 833* (G); Saw Pit I., Moose R., *Potter 886* (G); Hasey I., Moose R., *Potter 885* (G); N. end of Hayes I., Moose R., *M. T. Doutt 2040* (C); Ships Sand I., Moose Factory, *Gardner 28* (pt.), *77a* (A); south part of James Bay, *W. J. Wilson 53971* (O).—N. QUEBEC: East Main, *Potter 884* (G); White Beaver Portage, E. side of James Bay, *Todd June 22, 1914* (C).—LABRADOR: Sandwich Bay, *Woodworth 179* (G); sandy banks of Hamilton R., July 16, 1939, *M. T. Doutt 3190* (C).—S. QUEBEC & NEWFOUNDLAND: Big Brook, Nfld., *Fernald, Wiegand & Hotchkiss 28032* (G); Savage Cove, Nfld., *Fernald & Long 28033* (G); Eddie's Cove, Nfld., *Griscom 28034* (G); Flower Cove, Nfld., *Fernald, Long & Dunbar 26554* (G); mainland W. of Net I., old Fort Archipelago, *Lewis 130747* (O); Kegaska R., *Lewis 130750* (O); Mascanin, *Lewis 130748* (O); Tete-a-Perdrix, *Victorin & Rolland 18891, 24942, 24943, 24951* (G); Mingan, *C. W. Townsend June, 1909* (G).—Mingan Isls.: Ile Ste. Genevieve, *Lewis 130749* (O); same, *Victorin & Rolland 18920* (G); Ile aux Oiseaux, *Victorin & Rolland 24796* (O, G); Ile a la Proie, *same colls. 18936, 18937, 21707* (G).—Anticosti Isl.: Riv. des Caps, *Victorin & Rolland 27751* (O, G); Riv. MacDonald, *same colls. 27747* (O, G), *27749* (G); Riv. du Renard, *same colls. 27753* (O, G); Riv. a la Patate, *same colls. 21659* (G); Riv. Ste. Marie, *same colls. 24939, 24940* (G); Riv. au Saumon, *same colls. 21699, 27752* (G); Havre de la Patate, *same colls. 21658, 21710, 27750* (G); Cap de l'Ouest, *same colls. 27762* (G), *27760* (O, G); Riv. a l'Huile, *same colls. 27759* (G).

30. **Salix pedicellaris** Pursh var. **hypoglauca** Fernald in Rhod. **11**: 161 (1909); Potter in Rhod. **36**: 279 (1934).—*S. pedicellaris* Pursh, Schneider in Jour. Arn. Arb. **2**: 81 (1920), in part, **3**: 75 (1921), in part.—*S. myrtilloides* L., Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80**: 64C (1881), Cat. Can. Pl. 1^3: 451 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88**: 70J (1889), **1895**: 362L (1897).

In our region this plant appears to be confined to the southern and southwestern portions, with northern limits at Churchill and along the upper Hamilton River. It is, of course, much more common south of our area.

Schneider (l. c.) did not recognize the var. *hypoglauca* as worthy of distinction, but I am inclined to agree with Fernald that the widespread northern form with the under leaf surfaces glaucous is clearly separable from Pursh's typical form, which is more southern and has the leaves green on both sides (see Jour. Arn. Arb. **17**: 238, 1936).

Specimens examined: Manitoba: Churchill, *Gardner 65* (O, A); Echimamish R., *R. Bell 24647* (O).—Ontario: Severn R., June 26, 1896, *J. M. Macoun 24643* (O); near Doctor's Cr., 3 mi. E. of Moosonee, *M. T. Doutt 2243, 2244* (C).—N. Quebec: Mt. Sherrick, *Potter 902* (G); Rupert House, *Potter 900* (G); East Main, *Potter 901* (G); L. Mistassini, *J. M. Macoun 24640* (O).—Labrador: along portage to Grand Falls, Hamilton R., *M. T. Doutt 3295* (C).

31. **Salix simulans** Fernald in Rhod. **32:** 112 (1930); Lewis in Can. Field Nat. **45:** 227 (1931).

Known thus far only from its type collection, made by Dr. Harrison F. Lewis at Betchewun on the north shore of the Gulf of St. Lawrence, Aug. 26, 1928 (*130746,* O, G), and Sept. 3, 1929 (*130745,* O, G).

32. **Salix humilis** Marsh., Arbust. Amer. 140 (1785); Schneider in Jour. Arn. Arb. **2:** 20 (1920), **3:** 76 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 78 (1922); Lewis in Can. Field Nat. **45:** 227 (1931); Bowman in Rhod. **34:** 52 (1932).

Salix humilis, s. l., is widely distributed in eastern United States and southeastern Canada, but it is confined to the southern and southeastern parts of the area treated in this paper. Its northern limits are near the southern end of James Bay and on the Hamilton River. Typical *humilis,* however, is known in our region only on Anticosti and the north shore of the Gulf of St. Lawrence. The more northern material appears to represent the var. *keweenawensis* Farwell, distinguished in the following key.

Leaves, including the young ones, lanceolate to elliptic or oblanceolate, usually 3.5–4 or more times longer than wide, soon glabrate .....32. *S. humilis.*
Young leaves broader, more nearly rounded, the mature ones rather broadly obovate and commonly tomentose .....32a. *S. humilis* var. *keweenawensis.*

Specimens examined (typical form): S. Quebec: Boishébert, Baie des Moutons, *St. John 90354* (O, G); Harrington Harbor, *Lewis 130741* (O); Natashquan, *Victorin & Rolland 28096* (O, G); same, *St. John 90355* (O, G); Mascanin, *Lewis 130742, 130743* (O); E. of Matamek R., *Bowman 52, 57, 404* (G).—Mingan Isls.: Grande Ile, *Victorin & Rolland 24732* (O, G); Ile Ste. Genevieve, *Lewis 130744* (O).—Anticosti Isl.: Baie Ellis, *Victorin & Rolland 27741* (O, G); Riv. Jupiter, *same colls. 24945* (G).

32a. **Salix humilis** var. **keweenawensis** Farwell in Rep. Mich. Acad. Sci. **6:** 206 (1904); Schneider in Jour. Arn. Arb. **3:** 76 (1921), ed. footnote; Lewis in Can. Field Nat. **45:** 227 (1931); Potter in Rhod. **36:** 279 (1934).

Specimens examined: N. Quebec: East Main, *Potter 890* (G); L. Mistassini, *J. M. Macoun 24563* (O).—Labrador: Northwest River, Hamilton Inlet, *M. T. Doutt 3041, 3051* (C); Muskrat Falls, Hamilton R., *M. T. Doutt 3173* (C).—S. Quebec: Natashquan R., *C. W. Townsend July 24–Aug. 10, 1912* (G); Seven Islands, *Lewis 130739, 130740* (O).—Mingan Isls.: Ile a la Proie, *Victorin & Rolland 18912* (G); Grande Ile, *same colls. 21702* (G).

33. **Salix discolor** Muhl. in Neue Schr. Ges. Nat. Fr. Berlin **4:** 234, *t. 6, fig. 1* (1803); Macoun, J. in Geol. Surv. Can. Rept. Prog. **1879–80:** 64C (1881), Cat. Can. Pl. 1^3: 447 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1887–88:** 70J (1889), **1895:** 361L (1897); Schneider in Jour. Arn. Arb. **2:** 2 (1920), **3:** 76 (1921); ? Potter in Rhod. **36:** 279 (1934).

Entirely authentic specimens of *S. discolor* have been collected in our region only in the extreme southeastern parts. Those from the Hamilton River, James Bay, and northern Manitoba are all sterile and must be called *S. discolor* only provisionally. The first has rather shiny twigs and upper leaf surfaces and might better be placed with *S. planifolia.* Potter's specimen from James Bay might as well be called *S. glaucophylloides,* which occurs in that region. Bell's specimen from the Echimamish River is perhaps nearest of the three to typical *discolor.*

Among the specimens I have seen, and in the recent published lists, two varieties of *S. discolor* have been recognized in our region. These are var. *latifolia* Anderss. and var. *Overi* Ball. Both are distinguished from the typical form by their broader, commonly obovate-oblong leaves. So far as our material is concerned, I am unable to distinguish between the two, and I am accordingly taking up the older name for them, var. *latifolia*. It should be noted, however, that this is at best a rather tenuous varietal distinction, as there is an abundance of intermediate forms, and as it is doubtful whether any geographic segregation can be defined.

Leaves lanceolate to elliptic, more than 3–3.5 times longer than broad .....33. *S. discolor*.
Leaves broader, mostly 3–3.5 times longer than broad or less ..33a. *S. discolor* var. *latifolia*.

Specimens examined (typical form): Manitoba: ? Echimamish R., *R. Bell 24341* (O).—N. Quebec: ? Rupert House, *Potter 916* (G).—Labrador: ? tamarack swamp along portage to Grand Falls, Hamilton R., *M. T. Doutt 3320* (C).—S. Quebec & Newfoundland: Bard Harbor Hill, Highlands of St. John, *Fernald & Long 28040* (G); Doctor Brook, St. John Bay, *Wiegand & Gilbert 28039* (G); Tete-a-Perdrix, *Victorin & Rolland 24941* (G); Seven Islands, la Grosse-Boule, *same colls. 18914* (G).—Mingan Isls.: Ile Nue, *Victorin & Rolland 24783* (G); Ile a Bouleau, *same colls. 18894* (G).—Anticosti Isl.: Crique de la Chaloupe, *Victorin & Rolland 24788* (G); Riv. Jupiter, *same colls. 24944* (G); Riv. Belle, *same colls. 27743* (G).

33a. **Salix discolor** var. **latifolia** Anderss. in Svensk. Vet.-Akad. Handl. **6**: 84 (1867); Schneider in Jour. Arn. Arb. **2**: 4 (1920), **3**: 76 (1921); St. John in Victoria Mem. Mus. Mem. **126**: 78 (1922), in part.—*S. discolor* Muhl., St. John, l. c., in part.—*S. discolor* var. *Overi* Ball, Lewis in Can. Field Nat. **45**: 227 (1931).

Specimens examined: S. Quebec: Brouague, Riv. Shécatica, *St. John 90363* (G); Betchewun, *Lewis 130751* (O).—Mingan Isls.: Ile Ste. Genevieve, *St. John 90345* (O, G); Ile au Marteau, *St. John 90346, 90347, 90348* (O, G).—Anticosti Isl.: Riv. Belle, *Victorin & Rolland 27727* (O, G); Lac Sale, *same colls. 27757* (O, G); Riv. Vaureal, *same colls. 27728* (O, G); Riv. des Caps, *same colls. 27729* (G); Riv. MacDonald, *same colls. 27730, 27745, 27761* (G); Havre de la Patate, *same colls. 27732, 27733, 27748* (G).

34. **Salix planifolia** Pursh, Fl. Amer. Sept. **2**: 611 (1814); Schneider in Jour. Arn. Arb. **1**: 70 (1919), **3**: 77 (1921); Wetmore in Rhod. **25**: 8 (1923); Fernald in Rhod. **28**: 190 (1926); Lewis in Can. Field Nat. **45**: 227 (1931); Potter in Rhod. **36**: 279 (1934); Abbe in Rhod. **38**: 148 (1936); Polunin in Nat. Mus. Can. Bull. **92**: 171 (1940).—*S. phylicifolia* L., Bebb in Bull. Torr. Bot. Cl. **16**: 39 (1889); Macoun, J. M. in Can. Rec. Sci. **6**: 151 (1894); Tyrrell in Geol. Surv. Can. Ann. Rept. **1896**: 213F (1898); St. John in Victoria Mem. Mus. Mem. **126**: 78 (1922).—*S. chlorophylla* Anderss., Macoun, J., Cat. Can. Pl. **1**[3]: 446 (1886); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895**: 351L (1897); Floderus in Arkiv f. Bot. **29A**[18]: 27 (1939).

Salix planifolia is widely distributed and apparently common throughout all of our region except the extreme north. Polunin, l. c., gives its northern limits in southern Baffin Island and at Chesterfield, and it apparently has not been found at all on Southampton Island. Westward it extends into the northern Cordillera and is abundant in the central part of the Mackenzie basin.

Floderus, l. c., has maintained that the name *S. chlorophylla* Anderss. should be used for this species. The typification of Pursh's description was done principally by a process of elimination, as Floderus says (see Schneider in Jour. Arn. Arb. **1**: 75–76, 1919), but the result is none-the-less clear. There is no other shrub known in the region that could possibly fit the description. Floderus has rested his case largely upon the habit of the plant, stating that *S. chlorophylla* has "erect, dark-brown branches, pressed together and acute-angled, and erect leaves which are somewhat strongly rolled up in their earlier stages" (p. 32), while Pursh's description calls it a divaricate shrub with very smooth ("laevigatis")

branchlets and flat shining leaves. This is quite true, as far as it goes, but *S. planifolia* is a widely dispersed, highly variable species. In growth habit it may be a large shrub 10 feet or more high at the margin of a swamp, or a dwarfed, spreading shrub growing in exposed rocky places. The form of its branchlets varies greatly along with these differences in habit and habitat, much-dwarfed forms sometimes having rather heavy, thick twigs. The leaves acquire their characteristic form ". . . patentibus planis . . . ," when they begin to mature.

SPECIMENS EXAMINED: KEEWATIN: Chesterfield Inlet, *Tyrrell 1763* (O); same, *Polunin 2244* (O); Dubawnt L., Aug. 11, 1893, *Tyrrell 1763a* (O); near W. end of Baker L., Sept. 2, 1893, *Tyrrell 1763b* (O).—MANITOBA: Churchill, *J. M. Macoun 79153* (O); same, *Polunin 2023* (O).—ONTARIO: Hayes I., 2½ mi. E. of Moosonee, Moose R., *M. T. Doutt 2019, 2178* (C).—N. QUEBEC: Dilly Dally I., E. shore of James Bay, *Potter 888* (G); Brushy I., E. coast of James Bay, *Potter 887* (G); White Beaver Portage, E. of James Bay, *Todd June 22, 1914* (C); Long Pt., S. of Akuatuk Bay, E. shore of James Bay, *Todd July 19, 1914* (C); ? Tukarak I., Belcher Isls., *J. K. Doutt 13* (C).—Richmond Gulf: mainland south of Cairn I., *Abbe & Marr 3162* (M, G); Cairn I., *Abbe & Marr 3027, 3040, 3117* (M, G); Beach Cr., *Marr 4350* (M, G).—? Nastapoka R., *O. J. Murie May, 1914* (C); Northern Ungava, Aug. 17, 1897 (near Payne Bay), *Low 24772* (O); Ft. Chimo, *J. D. Soper 122085* (O).—LABRADOR: Bowdoin Harbor, *Sewell 128* (G); head of Ryan's Bay, *Woodworth 176* (G); Kangalaksiorvik, *Bryant 73, 74* (G); valley of Komaktorvik R., *Abbe 255* (O, G); head of Nachvak Bay, *Woodworth 177* (G); Saglek Bay, *Gardner 179* (G); Hebron, *Polunin 1035* (O, G); same, *Oldenburg 34A* (M); Okkak, *Wynne-Edwards 7494* (O); Fraser R., *Bishop 249* (G); Ford's Harbor, *R. Bell 24287* (O); Nain, *Bishop 250* (G); Egg Harbor, Huntingdon I., *H. S. Forbes 72* (O, G); 15 miles W. of Nain, *H. S. Forbes 70* (G); Anatolak, *Sewell 463, 464, 465, 466, 467* (G); Aillik, lat. 55° 11′, *Abbe 254* (G); Winter Harbor, *Gardner 113* (G); Gready I., *Gardner 240* (G); same, *H. S. Forbes 71* (O, G); Rigolet, *A. M. Ayre Aug., 1935* (G); Turner's Head, Hamilton Inlet, *Waghorne 81, 82* (photos), *83* (A); The Backway, L. Melville, *Wetmore 102922* (O); Northwest River, Hamilton Inlet, *M. T. Doutt 3062* (C); meadow on S. side of Grand Falls, Hamilton R., *M. T. Doutt 3371* (C); 10 mi. above mouth of Minipi R., Hamilton R., *M. T. Doutt 3214, 3215* (C); Sandwich Bay, *Woodworth 175* (G); Cartwright, *A. M. Ayre Aug., 1935* (G); same, *Woodworth 178* (G); same, *Malte 119974* (O); Caplin Bay, *Bishop 251* (O, G); west of Modiste, *Waghorne 5* (A); Ragged I., *Townsend 38* (G); Red Bay, *A. G. Huntsman Sept. 5, 1923* (G); Forteau, *Long 28038, 28055* (G).—S. QUEBEC: Blanc Sablon, *Fernald, Wiegand & Long 28007, 28008* (G); same, *Lewis 130729, 130730* (O); Bradore Bay, *Lewis 130731* (O); Riv. a la Truite, Brest, *St. John 90357* (O, G); Pt. Jones, Brest, *St. John 90368* (O, G); Riv. Shecatica, Brouague, *St. John 90358, 90359, 90360, 90364* (O, G), *90361, 90362* (O); Romaine, *St. John 90365, 90366* (O, G); Natashquan, *Lewis 130732, 130733, 130734, 130735* (O); same, *St. John 90367* (G); Betchewun, *Abbe 1108, 1116* (G); same, *Lewis 130736* (O); Seven Islands, Pte. a la Marmite, *Victorin & Rolland 18889* (G); Pte. aux Morts, *same colls. 18890* (G).—Mingan Isls.: Ile a la Proie, *Victorin & Rolland 18935* (G).—Anticosti: Baie Ellis, *Victorin & Rolland 27740* (O, G).

35. **Salix paraleuca** Fernald in Rhod. **16:** 175 (1914); Schneider in Jour. Arn. Arb. **1:** 75 (1919), **3:** 77 (1921); Lewis in Can. Field Nat. **45:** 227 (1931).—*S. chlorophylla* × *glaucophylloides* Floderus in Arkiv f. Bot. **29A**[18]**:** 35 (1939).

Apparently rare. *Salix paraleuca* was originally described from material collected along Grand River, in Gaspé County, Que., and has been found in our area only on the north shore of the Gulf of St. Lawrence.

SPECIMENS EXAMINED: Red Bay, long. 58° 56′, *Abbe 1111* (G); Lake Isl., Wapitagun, long. 60° 3′, *Abbe 1110* (G); same, *Lewis 130737, 130738* (O, G).

36. **Salix pedunculata** Fernald in Rhod. **28:** 188 (1926).—*S. chlorophylla* × *glaucophylloides* Floderus in Arkiv f. Bot. **29A**[18]**:** 35 (1939).

Known in our region only from its type locality on the Newfoundland side of the Straits of Belle Isle.

SPECIMENS EXAMINED: Savage Cove, Nfld., *Fernald & Long 28035* (O, G, TYPE).

37. **Salix amoena** Fernald in Rhod. **28:** 189 (1926).—*S. chlorophylla* × *glaucophylloides* Floderus in Arkiv f. Bot. **29A**[18]**:** 35 (1939).

Known in our region only from its type locality in extreme northern Newfoundland.

Specimen examined: Ha-Ha Mt., Ha-Ha Bay, Nfld., *Fernald, Wiegand, Long, Gilbert & Hotchkiss 28036* (G, type).

38. **Salix pellita** Anderss. in Svensk. Vet.-Akad. Handl. **6:** 139, *t. 7, fig. 72* (excl. fig. left of *g*) (1867); Schneider in Jour. Arn. Arb. **1:** 82 (1919), **3:** 77 (1921); St. John in Victoria Mem. Mus. Mem. **126:** 79 (1922), in part; Fernald in Rhod. **28:** 190 (1926); Lewis in Can. Field Nat. **45:** 227 (1931); Bowman in Rhod. **34:** 52 (1932).

Except for one collection near the southern end of James Bay, this species is as yet unknown in our region except in the southeastern part. It is apparently common on the north shore of the Gulf of St. Lawrence, and it is to be expected throughout much of the southern part of our area, for it is known westward at least to the Lake Winnipeg region. *Salix pellita* is a rather distinctive species and is fairly stable in its characters except for a glabrescent form, f. *psila,* which has been collected in our area only in southern Labrador and in the Mingan-Natashquan region and Anticosti.

Normal leaves silky-velvety and lustrous beneath .....38. *S. pellita.*
Normal leaves glabrescent .....38a. *S. pellita* f. *psila.*

Specimens examined (typical form): Ontario: Willow I., Moose Factory, *Gardner 21* (A).—Labrador: Muskrat Falls, Hamilton R., *M. T. Doutt 3172* (C); 2½ mi. from foot of Big Hill Portage, Hamilton R., *M. T. Doutt 3252* (C).—S. Quebec: Blanc Sablon, *Fernald & Wiegand 3182* (O, G); along Blanc Sablon R., *Fernald, Wiegand & Long 28056* (G); Pte. Jones, Brest, *St. John 90374* (O, G); Riv. St. Augustin, *St. John 90373* (O, G); Natashquan, *Victorin & Rolland 28171* (O, G); Moisie R., *Bowman 283* (G); Matamek R., *Bowman 80* (G); Mingan Isls., Ile Ste. Genevieve, *Victorin & Rolland 18934* (G).—Anticosti: Riv. a la Patate, *Victorin & Rolland 21680, 21682* (G); Riv. Vaureal, *same colls. 27738* (G); Riv. Dauphine, *same colls. 27744* (G); Crique de la Chaloupe, *same colls. 24787* (G); Jupiter R., *John Macoun 24302* (O).

38a. **Salix pellita** f. **psila** Schneider in Jour. Arn. Arb. **1:** 83 (1919), **3:** 77 (1921).

Specimens examined: Labrador: Cartwright, *Malte 119885* (O).—S. Quebec: Romaine, *Lewis 130714, 130715* (O); Natashquan, *Townsend July 24–Aug. 10, 1912* (G); same, *Lewis 130716, 130717* (O); same, *Victorin & Rolland 28100* (G); Riv. Mingan, *Victorin & Rolland 24804* (O, G), *24798* (G).—Mingan Isls.: Grande Ile, *Victorin & Rolland 25076* (G); Ile a Marteau, *same colls. 18893* (G).—Anticosti: Riv. McKane, *Victorin & Rolland 27742, 27746* (G); Baie Ellis, *same colls. 27739* (G); Riv. Chicotte, *same colls. 27758* (G); Pte. du Sud-Ouest, *same colls. 27768* (G).

39. **Salix arbusculoides** Anderss. in Svensk. Vet.-Akad. Handl. **6:** 147, *t. 8, fig. 81* (1867); Schneider in Jour. Arn. Arb. **2:** 84 (1920), **3:** 78 (1921); ? Størmer in Nyt. Mag. f. Naturv. **32:** 265 (1933), as *S. argyrocarpa* f. *serrata* Flod.; Grøntved in Rept. 5th Thule Exp. **2:** 32 (1936).

Apparently rare in our region, and confined to the west side of Hudson Bay. *Salix arbusculoides* is common and widely distributed in the Yukon and Mackenzie basins and in the northern Rocky Mountains. It appears to reach its eastern limit on the west coast of Hudson Bay. I have not seen the Johansen specimen from Churchill cited by Størmer. It was determined by Floderus as "*argyrocarpa* f. *serrata*" (name only), which strongly suggests *arbusculoides;* for when the latter grows in exposed situations it is a low shrub resembling *S. agyrocarpa* in habit, and to a certain extent in leaf shape and pubescence. It can be distinguished easily, however, by its closely and finely *serrate* leaves. Furthermore, *S. arbusculoides* has been collected at Churchill, while *S. argyro-*

carpa is otherwise unknown on the west coast of Hudson Bay and is apparently rare on the east coast (see below). Polunin's specimen from Chesterfield was apparently not cited by him, and is marked *"S. fullertonensis?"* in the herbarium. It is sterile, with very small, nearly glabrous, elliptic leaves that are acute at both ends, bright green above and glaucous beneath, and distinctly glandular-crenate. Close examination of the under surfaces of the leaves shows some appressed-silky, slightly rusty pubescence which, together with the form, color, and serration of the leaves, suggests *S. arbusculoides*.

SPECIMENS EXAMINED: KEEWATIN: ? Chesterfield, *Polunin 2148* (pt.) (G).—MANITOBA: Churchill, *J. M. Macoun 79152* (O, G). I have not seen the Birket-Smith specimen (*no. 1061*) cited by Grøntved (l. c.), but it also came from Churchill, and was determined by Enander.

40. **Salix argyrocarpa** Anderss. in Svensk. Vet.-Akad. Handl. **6:** 107, *t. 6, fig. 60* (1867); Macoun, J., Cat. Can. Pl. 1[3]: 445 (1886); Bebb in Bull. Torr. Bot. Cl. **16:** 211 (1889), Gray's Man. ed. 6, 483 (1890); Macoun, J. M. in Geol. Surv. Can. Ann. Rept. **1895:** 361L (1897); Schneider in Jour. Arn. Arb. **2:** 88 (1920), **3:** 78 (1921); ? St. John in Victoria Mem. Mus. Mem. **126:** 78 (1922); Abbe in Rhod. **38:** 148 (1936).

This species has its greatest development in our region in Labrador and the eastern part of the North Shore. It has been found at Richmond Gulf and on the Ungava River, however, and has been very doubtfully reported at Churchill (see discussion under *S. arbusculoides*). Its northern limit appears to be in the Cape Chidley region of Labrador, although Polunin did not include it in his list. Southward it extends to Gaspé and the New England mountains.

SPECIMENS EXAMINED: N. QUEBEC: Richmond Gulf: *E. C. & L. B. Abbe 3386* (M, G); Wiachewan Bay, *Abbe & Marr 3345* (M, G).—Along Ungava R., Aug. 9, 1896, *Spreadborough 13662* (O).—LABRADOR: Bowdoin Harbor, *Sewell 130* (G); Valley of Komaktorvik R., lat. 59° 15′, *Abbe 245* (G); head of Nachvak Bay, *Woodworth 181* (G); mouth of Fraser R., *Bishop 252* (G); Nain, *Bishop 253* (G); same, *Wynne-Edwards 7551* (O); 15 mi. W. of Nain, *H. S. Forbes 69* (G); Anatolak, *Sewell 458* (pt.), *462;* Hopedale, *Bishop 254* (O, G); same, *A. M. Ayre Aug., 1935* (G); same, *Sornborger 171* (G); same, *Dutilly, O'Neill & Duman 7423* (G); Holton, lat. 54° 35′, *Bishop 255* (G); Rigolet, *Townsend 28* (G); Ratter's Bight, Hamilton Inlet, *Waghorne* (A); Cunningham's Cove, Hamilton Inlet, *Bowdoin Coll. Exped. 171* (G); near Muskrat Falls, Hamilton R., *M. T. Doutt 3160, 3162, 3163* (C); along portage to Grand Falls, Hamilton R., *M. T. Doutt 3292, 3293* (C); Meadow on S. side of Grand Falls, *M. T. Doutt 3376* (C); Sandwich Bay, *Woodworth 180* (G); Winter Harbor, *Gardner 115* (G); Salmon Bight, *A. E. Porsild 26* (O, G).—S. QUEBEC: Blanc Sablon, *Fernald & Wiegand 4240* (G); ? same, *St. John 90353* (O, G); ? Riv. Shécatica, Brouague, *St. John 90352* (O, G); ? Riv. St. Augustin, *St. John 90351* (O, G).—I agree with Schneider (in herb.) that the St. John specimens are somewhat doubtfully placed here. His *nos. 90351* and *90353* approach *S. pellita*.

HYBRIDS

A number of willow hybrids of varying authenticity have been reported in our region, but only a few can be discussed here. Some students who have examined the Hudson Bay and Labrador material, notably the late Björn Floderus, have not hesitated to recognize a host of hybrids among the mazes of interspecific intermediates found there. In nearly all cases there is no experimental genetic evidence to support these hybrid concepts, so that they are usually nothing more than aggregations of species "characters" that one sees in individual specimens. It is exceedingly easy to find such "hybrids" most anywhere in the genus *Salix;* a surprising number of specimens and species, if such a method were carried to its logical conclusion, would have to be called hybrids of multiple parentage.

The purely practical requirements of willow taxonomy are of course scarcely served by the method, for its nomenclature quickly becomes so cumbersome as to be unusable. This does not mean that some form of hybridization has not entered into the making of our interspecific complexes, but until there is an opportunity to examine these problems by genetic methods, it seems unnecessarily misleading and confusing to set up a great number of "inspection" hybrids.

Two rather well-known hybrids have been recognized in the Eastern Arctic. These are × *S. Waghornei* Rydberg (*S. arctica* var. *Brownei* × *cordifolia*), and × *S. Peasei* Fernald (*S. herbacea* × *Uva-ursi*). I have seen specimens of the first from Northern Ungava (*Low 24770, 24771,* O), Turnavik (*J. M. Macoun 79157,* G), and Henley Harbor (*B. P. Mann June 28, 1864,* G). *Salix Peasei* has been found near Chesterfield Inlet by Dutilly (cf. Polunin in Nat. Mus. Can. Bull. **92**: 156), and Polunin considers that a Birket-Smith specimen from Cape Eskimo which he saw at Copenhagen should be placed here also. The Birket-Smith material was called "*Salix* (*arctica* Pall. ×) *S. stolonifera* Cham." by Enander (cf. Grøntved in Rept. 5th Thule Exp. **2**: 34, 1936).

A possible hybrid of *Salix humilis* and *S. planifolia* was collected by St. John at Baie des Moutons, Boishébert (*no. 90356,* G; cf. Victoria Mem. Mus. Mem. **126**: 78). It is a sterile specimen with leaves like *S. humilis* except that they are nearly glabrous. Polunin (l. c., p. 159) lists several numbers collected in our area which he thinks "may perhaps result from hybridization of *S. arctica* with *S. arctophila*" (Burwell, *Johansen 1222, 1223,* Herb. Copenhagen; *Malte 126798,* O; *Polunin 1101, 2635.*—Wakeham Bay, *Polunin 1432, 1433.*—Chesterfield, *Polunin 2144, 2145, 2150, 2151, 2209*). I have seen only two of these numbers: Malte's *no. 126798* (O) I have placed in *S. arctica* var. *Brownei;* and Polunin's *no. 2144,* although it might be intermediate, seems to me very close to *S. arctophila.* Another Polunin number from Chesterfield (*2436,* G) was also designated *S. arctica* × *arctophila* by him, but it also I would place with *S. arctophila.* I have also seen a specimen from Southampton Island marked *S. calcicola* × *S. Richardsonii* by Polunin (his *no. 2272,* G). This seems to me nearest *S. Richardsonii.*

Two of the hybrids noted by Grøntved (Rept. 5th Thule Exp. 2), *S. arctica* × *reptans* and *S. arctica* × *pulchra,* are both called *S. fullertonensis* by Polunin (see discussion of this species, above).

LIST OF NUMBERED COLLECTIONS OF SALIX CITED

Abbe, Ernst C., and others: 210 *reticulata;* 211, 212, 214 *vestita;* 217–221 *Uva-ursi;* 222–225 *herbacea;* 226 *arctica* var. *kophophylla;* 227 *arctica* var. *Brownei;* 228, 229 *arctica* var. *araioclada;* 230 *cordifolia* var. *typica;* 231 *arctica* var. *kophophylla;* 232, 233 *arctica* var. *Brownei;* 234, 235 *arctophila;* 238, 239 *cordifolia* var. *Macounii;* 240, 241 *cordifolia* var. *callicarpaea;* 242 *cordifolia* var. *Macounii;* 243 *cordifolia* var. *intonsa;* 244 *cordifolia* var. *callicarpaea;* 245 *argyrocarpa;* 246 *cordifolia* var. *Macounii;* 247, 248 *cordifolia* var. *intonsa;* 249 *cordifolia* var. *callicarpaea;* 250–252 *calcicola;* 254, 255 *planifolia;* 1106 *Uva-ursi;* 1107 *cordifolia* var. *Macounii;* 1108 *planifolia;* 1109 *cordifolia* var. *callicarpaea;* 1110, 1111 *paraleuca;* 1112 *candida;* 1113 *vestita;* 1114 *pyrifolia;* 1115 *cordifolia* var. *callicarpaea;* 1116 *planifolia;* 1117 *candida;* 1118 *vestita;* 1119 *cordifolia* var. *Macounii;* 1120 *Uva-ursi;* 3009, 3010 *candida;* 3027 *planifolia;* 3028, 3029 *arctophila;* 3035, 3037–3039 *glauca;* 3040 *planifolia;* 3042 *reticulata;* 3045, 3046 *candida;* 3058 *vestita;* 3085 *Uva-ursi;* 3087 *vestita;* 3096, 3097 *candida;* 3117 *planifolia;* 3155, 3156 *glauca;* 3160, 3161 *Uva-ursi;* 3162 *planifolia;* 3163 *candida;* 3183 *Uva-ursi;* 3271 *arctophila;* 3272 *glauca;* 3292 *vestita;* 3303 *cordifolia* var. *callicarpaea;* 3317 *glauca* var. *acutifolia;* 3385 *cordifolia* var. *callicarpaea;* 3386 *argyrocarpa;* 3401 *cordifolia* var. *callicarpaea;* 3402 *glauca;* 3403, 3406 *herbacea;* 3459, 3460 *reticulata;* 3461 *cordifolia* var. *callicarpaea;* 3461A *myrtillifolia;* 3481 *glauca* var. *acutifolia;* 3487 *arcto-*

phila; 3535 *vestita;* 3538, 3540, 3541 *cordifolia* var. *callicarpaea;* 3548 *candida;* 3593, 3594, 3768 *herbacea;* 3777 *vestita;* 3846 *calcicola;* 3884, 3966 *cordifolia* var. *callicarpaea;* 3967 *calcicola;* 3969 *vestita;* 3971 *reticulata;* 3983 *Uva-ursi;* 4054 *herbacea;* 4056 *Uva-ursi;* 4057 *reticulata;* 4080 *cordifolia* var. *callicarpaea;* 4081 *arctophila;* 4082 *cordifolia* var. *callicarpaea;* 4103 *cordifolia* var. *typica;* 4104 *herbacea;* 4126 *arctophila;* 4140 *reticulata;* 4142 *cordifolia* var. *callicarpaea;* 4144 *glauca;* 4185 *Uva-ursi;* 4264, 4265 *arctophila;* 4348 *glauca;* 4350 *planifolia;* 4369, 4376 *Uva-ursi.*

Bangsted, Helge: 1100 *alaxensis* var. *obovalifolia.*

Bell, Robert: 18785 *arctica* var. *kophophylla;* 18819, 18821 *cordifolia* var. *typica;* 18825, 18831, 18833 *arctophila;* 18849 *reticulata;* 18852 *Uva-ursi;* 18870 *herbacea;* 24287 *planifolia;* 24288 *cordifolia* var. *callicarpaea;* 24341 *discolor ?;* 24545, 24546 *cordifolia* var. *callicarpaea;* 24585 *lucida;* 24622 *cordifolia* var. *callicarpaea;* 24623 *arctica* var. *Brownei;* 24647 *pedicellaris* var. *hypoglauca;* 24739 *calcicola;* 24811 *vestita;* 54350, 54351, 54359 *reticulata;* 54362, 54363 *Uva-ursi.*

Bishop, Harlow: 231, 232 *vestita;* 233–236 *Uva-ursi;* 237–242 *arctophila;* 243A & B–248A & B *cordifolia* var. *callicarpaea;* 249–251 *planifolia;* 252–255 *argyrocarpa.*

Borden, L. E.: 63039 *Uva-ursi;* 63041 *reticulata;* 63042 *herbacea;* 63043 *fullertonensis;* 63044, 63045 *calcicola;* 63050 *arctica* var. *Brownei.*

Bowman, Paul W.: 52, 57 *humilis;* 80 *pellita;* 275 *lucida* var. *intonsa;* 283 *pellita;* 404 *humilis.*

Brooks, E. D.: 213, 215 *vestita;* 247 *cordifolia* var. *intonsa.*

Bryant, Owen: 63 *herbacea;* 65, 67 *Uva-ursi;* 68 *vestita;* 73, 74 *planifolia;* 75 *calcicola;* 77, 79 *arctophila;* 81, 84–87 *arctica* var. *Brownei;* 90, 92–94, 98, 99 *cordifolia* var. *callicarpaea.*

Burwash, L. T.: 132141, 132142 *fullertonensis.*

Comer, George: 54075 *fullertonensis.*

Doutt, J. K.: 1 *calcicola;* 3, 11 *Uva-ursi;* 12 *arctophila;* 13 *planifolia;* 28 *Uva-ursi;* 59, 60 *cordifolia* var. *callicarpaea;* 61 *Uva-ursi;* 84 *reticulata;* 122 *cordifolia* var. *callicarpaea;* 123 *cordifolia* var. *typica;* 124 *cordifolia* var. *callicarpaea;* 125 *reticulata;* 203 *herbacea;* 264 *cordifolia* var. *callicarpaea;* 329 *arctophila;* 330 *cordifolia* var. *callicarpaea;* 370 *herbacea.*

Doutt, M. T.: 2000 *longifolia;* 2019 *planifolia;* 2040 *Bebbiana;* 2147 *adenophylla;* 2148 *candida;* 2149 *longifolia;* 2178 *planifolia;* 2243, 2244 *pedicellaris* var. *hypoglauca;* 2265 *calcicola;* 2267 *reticulata;* 2268 *arctophila;* 2284 *brachycarpa* var. *antimima;* 2321 *arctophila;* 2370 *cordifolia* var. *callicarpaea;* 2394, 2397 *arctophila;* 2460 *cordifolia* var. *intonsa;* 2528 *glauca* var. *acutifolia;* 2532, 2543 *Uva-ursi;* 2581 *glaucophylloides;* 2582 *cordifolia* var. *callicarpaea;* 2620 *vestita* var. *erecta;* 2635 *Uva-ursi;* 2645 *arctophila;* 2682 *vestita* var. *erecta;* 2697 *cordifolia* var. *callicarpaea;* 2701 *reticulata;* 3001 *Uva-ursi;* 3003, 3022 *cordifolia* var. *callicarpaea;* 3033 *arctophila;* 3041, 3051 *humilis* var. *keweenawensis;* 3062 *planifolia;* 3124 *pyrifolia;* 3159 *lucida* var. *angustifolia;* 3160, 3162, 3163 *argyrocarpa;* 3172 *pellita;* 3173 *humilis* var. *keweenawensis;* 3190 *Bebbiana;* 3214, 3215 *planifolia;* 3252 *pellita;* 3292, 3293 *argyrocarpa;* 3294 *pyrifolia;* 3295 *pedicellaris* var. *hypoglauca;* 3320 *discolor ?;* 3371 *planifolia;* 3372 *arctophila;* 3374 *vestita* var. *erecta;* 3375 *arctophila;* 3376 *argyrocarpa;* 3377 *cordifolia* var. *callicarpaea.*

Dutilly, Père A.: 601, 6704 *alaxensis* var. *obovalifolia.*

Dutilly, Père A., H. O'Neill, & M. Duman: 7083 *pyrifolia;* 7201 *arctophila;* 7423 *argyrocarpa;* 7649 *vestita;* 87001 *arctophila;* 87125 *herbacea;* 87452 *cordifolia* var. *callicarpaea;* 87453 *reticulata;* 97300 *candida.*

Fernald, M. L., and others: 1588, 1589 *herbacea;* 1602–1605 *Wiegandii;* 3146 *lucida;* 3161 *myrtillifolia;* 3169 *Uva-ursi;* 3180 *candida;* 3182 *pellita;* 3185 *Wiegandii;* 3189 *candida;* 3199 *vestita;* 3209 *cordifolia* var. *typica;* 3212 *cordifolia* var. *callicarpaea;* 3213, 3214 *cordifolia* var. *tonsa;* 3223, 3225, 3226 *cordifolia* var. *callicarpaea;* 4240 *argyrocarpa;* 26554 *Bebbiana;* 26559, 26560 *pyrifolia;* 26564 *calcicola;* 26570 *cordifolia* var. *eucycla;* 26571 *cordifolia* var. *Macounii;* 26579, 26580 *arctophila;* 26585 *reticulata;* 27933 *lucida;* 27949 *jejuna;* 27956, 27965 *arctophila;* 27978 *cordifolia* var. *typica;* 27986 *jejuna;* 27990 *cordifolia* var. *Macounii;* 28006 *myrtillifolia* var. *brachypoda;* 28007, 28008 *planifolia;* 28009, 28010 *myrtillifolia* var. *brachypoda;* 28024 *candida* var. *denudata;* 28026–28028 *cryptodonta;* 28031 *cordifolia* var. *intonsa;* 28032, 28033 *Bebbiana;* 28035 *pedunculata;* 28036 *amoena;* 28042 *discolor;* 28056 *pellita.*

Forbes, H. S.: 62 *herbacea;* 64, 66 *Uva-ursi;* 69 *argyrocarpa;* 70–72 *planifolia;* 76, 78, 80 *arctophila;* 82, 83 *arctica* var. *Brownei;* 91 *arctophila;* 95, 96, *cordifolia* var. *callicarpaea;* 100 *cordifolia* var. *intonsa.*

FREUCHEN, PETER: 23 *alaxensis* var. *obovalifolia;* 691 *hudsonensis;* 734 *arctica* var. *Brownei.*

GARDNER, G.: 12 *cordifolia* var. *callicarpaea;* 13 *glauca* var. *acutifolia;* 21 *pellita;* 22 *lucida* var. *angustifolia;* 27 *cordifolia* var. *callicarpaea;* 28 (pt.) *Bebbiana;* 28 (pt.) *glauca* var. *acutifolia;* 41 *arctophila;* 57, 60 *cordifolia* var. *callicarpaea;* 62 (pt.) *arctophila;* 62 (pt.) *glaucophylloides;* 65 *pedicellaris* var. *hypoglauca;* 72 *calcicola;* 77 *lucida* var. *angustifolia;* 77A, 95 *Bebbiana;* 99 *arctophila;* 105 *longifolia;* 106 *cordifolia* var. *callicarpaea;* 113 *planifolia;* 114 *arctophila;* 115 *argyrocarpa;* 121, 178 *cordifolia* var. *callicarpaea;* 179 *planifolia;* 193, 216 *arctophila;* 240 *planifolia;* 244, 245 *cordifolia* var. *callicarpaea;* 333, 342 *alaxensis* var. *obovalifolia;* 355 *arctophila;* 383, 384 *glauca* var. *acutifolia;* 408 *calcicola;* 432 *brachycarpa* var. *antimima;* 435, 485, 487 *glauca* var. *acutifolia.*

GRISCOM, LUDLOW: 28034 *Bebbiana.*

LEWIS, HARRISON F.: 130688, 130689 *vestita;* 130697–130701 *cordifolia* var. *Macounii;* 130702, 130703 ? *cordifolia* var. *intonsa;* 130704, 130705 *cordifolia* var. *callicarpaea;* 130706 *cordifolia* var. *typica;* 130707–130710 *cordifolia* var. *callicarpaea;* 130711, 130712 *cordifolia* var. *typica;* 130713 *cordifolia* var. *callicarpaea;* 130714–130717 *pellita* f. *psila;* 130718 *candida* var. *denudata;* 130719–130722 *candida;* 130723–130727 *pyrifolia;* 130728 *glaucophylloides;* 130729–130736 *planifolia;* 130737, 130738 *paraleuca;* 130739, 130740 *humilis* var. *keweenawensis;* 130741–130744 *humilis;* 130745, 130746 *simulans;* 130747–130750 *Bebbiana;* 130751 *discolor* var. *latifolia;* 130752, 130753 *lucida* var. *intonsa;* 130754 *lucida.*

LONG, BAYARD: 28038, 28055 *planifolia.*

LOW, A. P.: 6048 *vestita;* 6049, 6050 *arctophila;* 6051 *Uva-ursi;* 13687a *cordifolia* var. *callicarpaea;* 23035 *Uva-ursi;* 23037 *arctica* var. *Brownei;* 23038 *calcicola;* 23039 *arctophila;* 24769 *cordifolia* var. *Macounii;* 24770, 24771 × *Waghornei;* 24772 *planifolia;* 24774 *arctophila;* 24775 *cordifolia* var. *callicarpaea;* 54353 *herbacea;* 63269 *arctophila;* 63270 *reticulata;* 63271 *arctophila ?;* 63272 *brachycarpa* var. *antimima.*

MACOUN, J. M.: 2004 *adenophylla;* 2028 *serissima;* 18822 *hudsonensis;* 18827 *arctophila;* 18847, 18850 *reticulata;* 24303 *candida;* 24513 *cordifolia* var. *Macounii;* 24563 *humilis* var. *keweenawensis;* 24618 *serissima;* 24625 *calcicola;* 24635 *glauca* var. *acutifolia;* 24636 *Bebbiana;* 24640, 24643 *pedicellaris* var. *hypoglauca;* 24819 *vestita;* 79142 *reticulata;* 79143 *vestita* var. *erecta;* 79144 *candida;* 79145 *herbacea;* 79146, 79147 *reticulata;* 79148 *hudsonensis;* 79149 *herbacea;* 79150, 79151 *Uva-ursi;* 79152 *arbusculoides;* 79153 *planifolia;* 79154, 79155 *calcicola;* 79156, 79156a *brachycarpa* var. *antimima;* 79157 × *Waghornei;* 79158 *arctophila;* 79159 *glauca* var. *acutifolia;* 79161 *fullertonensis;* 79162 *hudsonensis ?;* 79163–79166 *fullertonensis;* 79167 *hudsonensis;* 79168 *arctophila.*

MACOUN, JOHN: 4 *reticulata;* 19, 34 *lutea;* 18818 *arctophila;* 24302 *pellita;* 24349 *glaucophylloides;* 24460 *brachycarpa;* 24564 *glaucophylloides;* 24584 *serissima;* 24813 *vestita;* 100616 *candida.*

MALTE, M. O.: 118598 *arctica* var. *kophophylla;* 118617 *arctica* var. *Brownei;* 118620 *cordifolia* var. *callicarpaea;* 118644, 118645, 118654 *reticulata;* 118658 *cordifolia* var. *typica;* 119874 *cordifolia* var. *intonsa;* 119885 *pellita* f. *psila;* 119900 *pyrifolia;* 119974 *planifolia;* 119992 *reticulata;* 119995 *Uva-ursi;* 120005 *arctica* var. *kophophylla;* 120019 *herbacea;* 120021 *calcicola;* 120022 *reticulata;* 120039 *Uva-ursi;* 120053 *herbacea;* 120065 *Uva-ursi;* 120170, 120172 *arctica* var. *kophophylla;* 120182, 120184, 120213 *cordifolia* var. *callicarpaea;* 120217 *calcicola;* 120220 *glauca* var. *acutifolia;* 120221 *reticulata;* 120222 *arctica* var. *Brownei;* 120224 *cordifolia* var. *callicarpaea;* 120225 *calcicola;* 120226, 120228, 120230 *cordifolia* var. *callicarpaea;* 120231 *glauca* var. *acutifolia;* 120232 *cordifolia* var. *callicarpaea;* 120233 *glauca* var. *acutifolia;* 120234 *arctica* var. *Brownei;* 120235, 120251 *cordifolia* var. *callicarpaea;* 120253 *arctica* var. *Brownei;* 120255, 120258 *cordifolia* var. *callicarpaea;* 120281 *calcicola;* 120416 *arctica* var. *Brownei;* 120463 *herbacea;* 120466, 120483, 120486, 120492 *hudsonensis;* 120516 *alaxensis* var. *obovalifolia;* 120517, 120543 *hudsonensis;* 120565 *fullertonensis;* 120566 *arctophila;* 120576, 120597, 120691 *Richardsonii;* 120701, 120703, 120705 *cordifolia* var. *callicarpaea;* 120745 *herbacea;* 120755 *cordifolia* var. *callicarpaea;* 120757 *calcicola;* 120760 *arctica* var. *kophophylla;* 120762 *cordifolia* var. *callicarpaea;* 120764 *cordifolia* var. *typica;* 120766, 120767 *cordifolia* var. *callicarpaea;* 120769 *calcicola;* 120771, 120773, 120774 *cordifolia* var. *callicarpaea;* 120793, 120796 *reticulata;* 120812 *cordifolia* var. *callicarpaea;* 120817, 120820 *arctica* var. *kophophylla;* 120822 *cordifolia* var. *callicarpaea;* 120831 *Uva-ursi;* 120882 *arctica* var. *Brownei;* 120888 *reticulata;* 120889 *arctica* var. *Brownei;* 120890 *calcicola;* 120901, 120903 *arctica* var. *Brownei;* 120908 *cordifolia* var. *typica;* 120915, 120917 *arctica* var. *Brownei;* 120954 *cordifolia* var. *callicarpaea;* 120976 *herbacea;* 121050, 121052 *Uva-ursi;* 121056, 121062 *reticulata;* 126775 *arctophila;* 126798

arctica var. *Brownei;* 126800 *herbacea;* 126803, 126804 *arctica* var. *Brownei;* 126805 *Uva-ursi;* 126816 *arctica* var. *Brownei;* 126818 *calcicola;* 126819, 126820 *arctica* var. *Brownei;* 126821 *calcicola;* 126822 *reticulata;* 126824, 126831, 126833 *calcicola;* 126835 *arctica* var. *Brownei;* 126837 *Uva-ursi;* 126838, 126905, 126909 *calcicola;* 126917 *cordifolia* var. *callicarpaea;* 126941 *Uva-ursi;* 127002 *cordifolia* var. *callicarpaea;* 127004 *glauca* var. *acutifolia;* 127006, 127008 *cordifolia* var. *callicarpaea;* 127012 *glauca* var. *acutifolia;* 127014 *cordifolia* var. *callicarpaea;* 127016 *arctophila;* 127020 *herbacea;* 127026 *brachycarpa* var. *antimima;* 127027, 127029 *calcicola;* 127031 *cordifolia* var. *intonsa;* 127034 *arctica* var. *Brownei;* 127038 *calcicola;* 127039 *arctica* var. *Brownei;* 127040 *cordifolia* var. *callicarpaea;* 127042 *calcicola;* 127044, 127046 *cordifolia* var. *callicarpaea;* 127048 *herbacea;* 127049, 127051, 127053 *cordifolia* var. *callicarpaea.*

Martin: 2 *cordifolia* var. *Macounii;* 4 *cordifolia* var. *callicarpaea.*

Ney, C. H., & J. Courtright: 1823 *calcicola;* 2402 *arctica* var. *Brownei;* 2411 *cordifolia* var. *callicarpaea;* 2424 *calcicola;* 2427 *herbacea;* 2435 *Uva-ursi.*

Oldenburg, M. E.: 5 *arctophila;* 17, 25 *cordifolia* var. *callicarpaea;* 34 *planifolia;* 37A, 39C *vestita;* 51A *herbacea;* 51B *Uva-ursi;* 82 *reticulata;* 157B *Uva-ursi;* 157C (pt.) *cordifolia* var. *callicarpaea;* 157C (pt.) *calcicola;* 157C (pt.) *arctophila;* 157C (pt.) *arctica* var. *Brownei;* 170A (pt.) *reticulata;* 170A (pt.) *arctophila ?;* 188A *calcicola* var. *Nicholsiana;* 188B *arctica* var. *Brownei;* 188C *reticulata;* 188D *Richardsonii;* 212A *arctophila;* 230A (pt.) *Uva-ursi;* 230A (pt.) *arctophila;* 230B, 255A (pt.) *calcicola;* 255A (pt.) *cordifolia* var. *callicarpaea.*

Polunin, Nicholas: 90 *arctophila;* 1001 *cordifolia* var. *callicarpaea;* 1013 *vestita;* 1014 (pt.) *Uva-ursi;* 1014 (pt.) *arctophila;* 1035 *planifolia;* 1053 *cordifolia* var. *callicarpaea;* 1101, 1301, 1349 *arctica* var. *Brownei;* 1380 *herbacea;* 1385 *cordifolia* var. *callicarpaea;* 1536 *arctophila;* 1548 *cordifolia* var. *callicarpaea;* 1574 *calcicola;* 1764 *arctophila;* 1864 *brachycarpa* var. *antimima;* 2013 *candida;* 2023 *planifolia;* 2025, 2034, 2073 *glauca* var. *acutifolia;* 2146 *hudsonensis;* 2148 (pt.) *arbusculoides ?;* 2148 (pt.) *arctophila;* 2149 *alaxensis* var. *obovalifolia;* 2181, 2197 *fullertonensis;* 2199 *hudsonensis;* 2233 *herbacea;* 2237 *arctophila;* 2244 *planifolia.*

Porsild, A. E.: 21 *herbacea;* 26 *argyrocarpa;* 27 *herbacea;* 28 *Uva-ursi;* 29–31 *cordifolia* var. *callicarpaea;* 32, 33 *arctophila;* 89 *cordifolia* var. *callicarpaea;* 90–92 *arctophila;* 93, 129, 130 *cordifolia* var. *callicarpaea;* 180 *Uva-ursi;* 181 *vestita.*

Potter, David: 833, 884–886 *Bebbiana;* 887, 888 *planifolia;* 890 *humilis* var. *kewcenawensis;* 891, 893 *candida* var. *denudata;* 894, 895 *longifolia;* 896–898 *candida;* 899 *candida* var. *denudata;* 900–902 *pedicellaris* var. *hypoglauca;* 903 *glaucophylloides;* 904 *brachycarpa* var. *antimima;* 905 *brachycarpa;* 906, 907 *brachycarpa* var. *antimima;* 908 *adenophylla;* 909 *cordifolia* var. *callicarpaea;* 910, 911 *lucida* var. *angustifolia;* 912 *lutea;* 913 *cordata;* 914 *cordifolia* var. *callicarpaea;* 915 *myrtillifolia;* 916 *discolor ?;* 917 *glaucophylloides.*

Preble, E. A., & A. E.: 41 *brachycarpa* var. *antimima;* 43, 46 *hudsonensis.*

Ross, A. H. D.: 24358 *adenophylla.*

St. John, Harold: 90345–90348 *discolor* var. *latifolia;* 90349 *lucida;* 90350 *lucida* var. *intonsa;* 90351–90353 *argyrocarpa ?;* 90354, 90355 *humilis;* 90356 *humilis* × *planifolia;* 90357–90362 *planifolia;* 90363 *discolor* var. *latifolia;* 90364–90368 *planifolia;* 90369 *cordata;* 90370 *pyrifolia;* 90371, 90372 *candida;* 90373, 90374 *pellita;* 90375, 90376 *Uva-ursi;* 90377 *vestita;* 90378 *vestita* var. *psilophylla;* 90835–90840 *cordifolia* var. *callicarpaea;* 90841 *cordifolia* var. *cucycla;* 90842 *cordifolia* var. *callicarpaea;* 90843, 90844 *arctophila;* 90845, 90846 *cordifolia* var. *callicarpaea.*

Sewell, C. S.: 11 *vestita;* 128 *planifolia;* 129 *arctophila;* 130 *argyrocarpa;* 457 *herbacea;* 458 (pt.) *argyrocarpa;* 458 (pt.) *Uva-ursi;* 459 *cordifolia* var. *callicarpaea;* 460 *arctophila;* 462 *argyrocarpa;* 463–467 *planifolia.*

Soper, J. D.: 111432, 122083 *cordifolia* var. *callicarpaea;* 122084 *vestita;* 122085 *planifolia;* 122086 *vestita.*

Sornborger, J. D.: 1 *cordifolia* var. *Macounii;* 2 *arctophila;* 4 *cordifolia* var. *callicarpaea;* 5 *arctophila;* 7 *cordifolia* var. *callicarpaea;* 8, 9 *Uva-ursi;* 10, 117 *herbacea;* 171 *argyrocarpa;* 176 *Uva-ursi;* 179 *vestita.*

Spreadborough, Wm.: 13655 *Uva-ursi;* 13656 *vestita;* 13661 *reticulata;* 13662 *argyrocarpa;* 13681 *herbacea;* 13683 *glauca* var. *acutifolia;* 13683a *cordifolia* var. *callicarpaea;* 13687 *arctophila;* 13697 *calcicola;* 24510 *glauca* var. *acutifolia;* 54354, 54355 *arctophila;* 54361 *Uva-ursi;* 62015 *calcicola;* 62618 *hudsonensis;* 62619 *lucida;* 62620(1) *brachycarpa* var. *antimima ?;* 62620(2) *glauca;* 62621 *longifolia;* 62628 *serissima;* 62629 *reticulata;* 62630, 62631 *adenophylla.*

Stecker, A.: 3 *cordifolia* var. *intonsa.*

Townsend, C. W.: 16 *cordifolia* var. *intonsa;* 19 *arctophila;* 28 *argyrocarpa;* 32 *arctophila;* 36 *Uva-ursi;* 38 *planifolia.*

Turner, L. M.: 627 *herbacea;* 629 *Uva-ursi;* 4817 *arctica* var. *Brownei;* 6310 *vestita.*

Tyrrell, J. W.: 1711 *cordifolia* var. *callicarpaea;* 1717 *herbacea;* 1762 *Richardsonii;* 1763, 1763a, 1763b *planifolia;* 1765 *alaxensis* var. *obovalifolia;* 18834 *arctophila.*

Victorin, Fr. Marie: 4348 *candida;* 4349-4351 *cordifolia* var. *callicarpaea;* 4374 *candida.*

Victorin, Fr. Marie, & Fr. Rolland-Germain: 18884 *lucida;* 18885 *laurentiana;* 18886 *lucida;* 18889, 18890 *planifolia;* 18891 *Bebbiana;* 18892 *glaucophylloides;* 18893 *pellita* f. *psila;* 18894 *discolor;* 18895–18900 *vestita;* 18901 *vestita* var. *erecta;* 18902–18907 *candida;* 18908 *laurentiana;* 18909 *glaucophylloides;* 18910, 18911 *cordifolia* var. *callicarpaea;* 18912 *humilis* var. *keweenawensis;* 18913 *cordifolia* var. *callicarpaea;* 18914 *discolor;* 18915 *cordifolia* var. *Macounii;* 18916 *cordifolia* var. *callicarpaea;* 18917 *laurentiana;* 18918, 18919 *pyrifolia;* 18920 *Bebbiana;* 18921 *glaucophylloides;* 18922–18930 *cordifolia* var. *callicarpaea;* 18931, 18932 *cordifolia* var. *Macounii;* 18933 *glaucophylloides;* 18934 *pellita;* 18935 *planifolia;* 18936, 18937, 21658, 21659 *Bebbiana;* 21679 *cryptodonta;* 21680, 21682 *pellita;* 21683 *vestita;* 21684 *candida;* 21685 *vestita;* 21686 *cordifolia var. typica;* 21687 *lucida* var. *intonsa;* 21688 *cordifolia* var. *callicarpaea;* 21689 *candida;* 21690 *cordifolia* var. *callicarpaea;* 21691 *candida;* 21698 *cordifolia* var. *callicarpaea;* 21699 *Bebbiana;* 21700, 21701 *glaucophylloides;* 21702 *humilis* var. *keweenawensis;* 21703 *cordifolia* var. *Macounii;* 21704, 21705 *candida;* 21707 *Bebbiana;* 21709 *candida;* 21710 *Bebbiana;* 24731 *myrtillifolia;* 24732 *humilis;* 24733 *candida;* 24734–24738 *brachycarpa;* 24739 *candida;* 24783 *discolor;* 24785, 24786 *candida;* 24787 *pellita;* 24788 *discolor;* 24789, 24790, 24795 *candida;* 24796 *Bebbiana;* 24797 *lucida;* 24798 *pellita* f. *psila;* 24799 *candida;* 24800 *vestita;* 24801 *glaucophylloides;* 24802 *lucida* var. *intonsa;* 24803 *glaucophylloides;* 24804 *pellita* f. *psila;* 24805 *glaucophylloides;* 24939, 24940 *Bebbiana;* 24941 *discolor;* 24942, 24943 *Bebbiana;* 24944 *discolor;* 24945 *humilis;* 24951 *Bebbiana;* 24974 *lucida* var. *intonsa;* 25076 *pellita* f. *psila;* 25182–25186 *cordifolia* var. *Macounii;* 25187, 25188 *cordifolia* var. *callicarpaea;* 25300 *cordifolia* var. *Macounii;* 25922, 25925 *cordifolia* var. *callicarpaea;* 25932 *cordifolia* var. *Macounii;* 27727–27730 *discolor* var. *latifolia;* 27731 *candida;* 27732, 27733 *discolor* var. *latifolia;* 27734 *myrtillifolia;* 27735, 27736 *candida;* 27737 *myrtillifolia;* 27738 *pellita;* 27739 *pellita* f. *psila;* 27740 *planifolia;* 27741 *humilis;* 27742 *pellita* f. *psila;* 27743 *discolor;* 27744 *pellita;* 27745 *discolor* var. *latifolia;* 27746 *pellita* f. *psila;* 27747 *Bebbiana;* 27748 *discolor* var. *latifolia;* 27749–27753 *Bebbiana;* 27754 *lucida* var. *intonsa;* 27755, 27756 *glaucophylloides;* 27757 *discolor* var. *latifolia;* 27758 *pellita* f. *psila;* 27759, 27760 *Bebbiana;* 27761 *discolor* var. *latifolia;* 27762 *Bebbiana;* 27764 *brachycarpa;* 27765 *cordifolia* var. *callicarpaea;* 27766 *candida* var. *denudata;* 27767 *brachycarpa;* 27768 *pellita* f. *psila;* 27769 *arctophila;* 28096 *humilis;* 28098 *cordata;* 28100 *pellita* f. *psila;* 28106, 28116 *lucida* var. *intonsa;* 28171 *pellita.*

Waghorne, A. C.: 2 *vestita;* 3 (pt.) *pyrifolia;* 3 (pt.) *vestita;* 4 *arctophila;* 5 *planifolia;* 13 (pt.) *arctophila;* 13 (pt.) *candida;* 21 *cordifolia* var. *callicarpaea;* 33 *cordifolia* var. *tonsa;* 36 *cordifolia* var. *intonsa;* 38 *Uva-ursi;* 50, 51 *cordifolia* var. *callicarpaea;* 69 *arctophila;* 81–83 *planifolia;* 86, 91, 94, 95 *cordifolia* var. *callicarpaea;* 112 *herbacea;* 18829 *cordifolia* var. *callicarpaea.*

Wetmore, R. H.: 102920 *lucida* var. *angustifolia;* 102921 *lucida* var. *intonsa;* 102922 *planifolia;* 102923 *cordifolia* var. *callicarpaea.*

Wiegand, K. M., and others: 27950 *jejuna;* 27982 *cordifolia* var. *eucycla;* 27987, 27988 *cordifolia* var. *Macounii;* 27991 *cordifolia* var. *eucycla;* 28015 *calcicola;* 28039 *discolor.*

Wilson, W. J.: 53970 *candida;* 53971 *Bebbiana.*

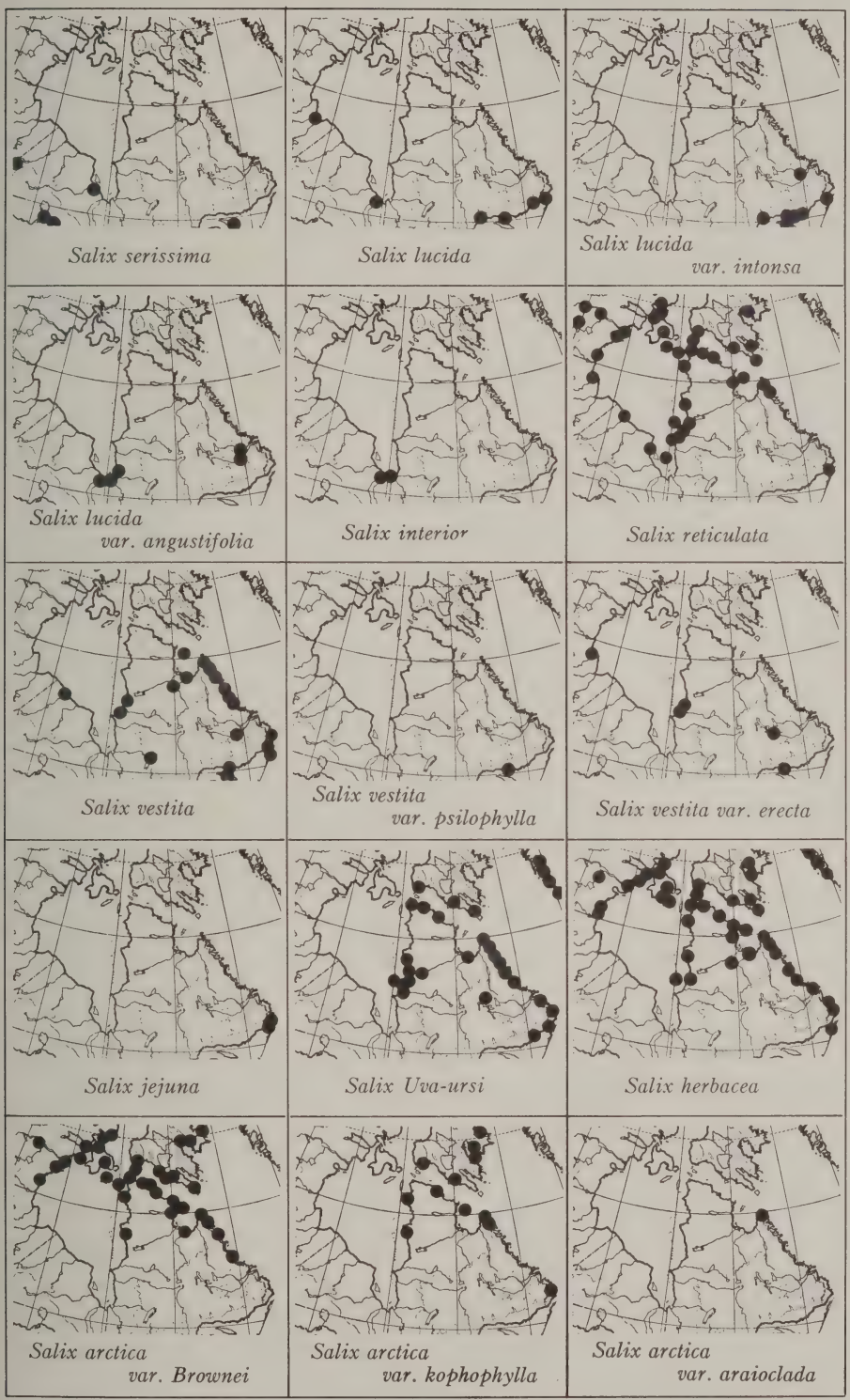
Woodworth, R. H.: 143 *reticulata;* 144 *vestita;* 145–148 *Uva-ursi;* 149–152 *herbacea;* 153 *arctica* var. *Brownei;* 154 *arctica* var. *kophophylla;* 155–161 *arctophila;* 162 *cordifolia* var. *tonsa;* 162½–165 *cordifolia* var. *intonsa;* 166, 166½ *cordifolia* var. *Macounii;* 167–173 *cordifolia* var. *callicarpaea;* 174 *calcicola;* 175–178 *planifolia;* 179 *Bebbiana;* 180, 181 *argyrocarpa.*

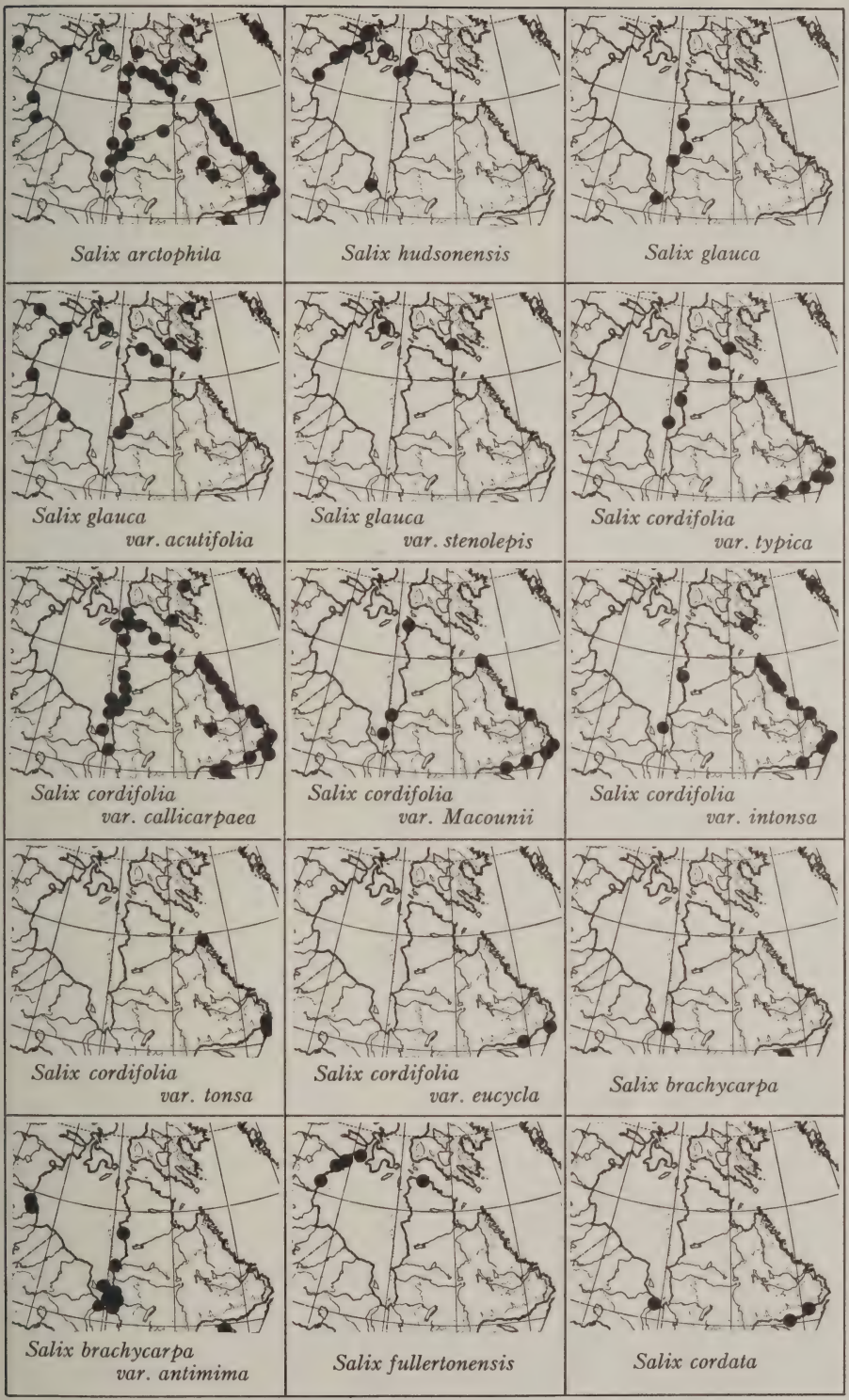
Wynne-Edwards, V. C.: 13 *arctophila;* 7051, 7052 *cordifolia* var. *callicarpaea;* 7053 *herbacea;* 7059, 7060 *cordifolia* var. *callicarpaea;* 7061 *vestita;* 7093 *Uva-ursi;* 7094 *arctophila;* 7162 *reticulata;* 7466 *vestita;* 7494 *planifolia;* 7495 *cordifolia* var. *intonsa;* 7551 *argyrocarpa.*

EXPLANATION OF PLATES I–IV

Range maps of the species, varieties, and forms of *Salix* in the Hudson Bay Region and Labrador Peninsula.

Arnold Arboretum,
Harvard University.


Salix serissima
Salix lucida
Salix lucida
var. intonsa
Salix lucida
var. angustifolia
Salix interior
Salix reticulata
Salix vestita
Salix vestita
var. psilophylla
Salix vestita var. erecta
Salix jejuna
Salix Uva-ursi
Salix herbacea
Salix arctica
var. Brownei
Salix arctica
var. kophophylla
Salix arctica
var. araioclada


Salix arctophila
Salix hudsonensis
Salix glauca
Salix glauca var. acutifolia
Salix glauca var. stenolepis
Salix cordifolia var. typica
Salix cordifolia var. callicarpaea
Salix cordifolia var. Macounii
Salix cordifolia var. intonsa
Salix cordifolia var. tonsa
Salix cordifolia var. eucycla
Salix brachycarpa
Salix brachycarpa var. antimima
Salix fullertonensis
Salix cordata

Salix lutea

Salix myrtillifolia

Salix myrtillifolia
var. brachypoda

Salix glaucophylloides

Salix adenophylla

Salix pyrifolia

Salix Richardsonii

Salix calcicola

Salix calcicola
var. Nicholsiana

Salix Wiegandii

Salix alaxensis
var. obovalifolia

Salix laurentiana

Salix candida

Salix candida
var. denudata

Salix cryptodonta

Salix Bebbiana
Salix pedicellaris var. hypoglauca
Salix simulans
Salix humilis
Salix humilis var. keweenawensis
Salix discolor
Salix discolor var. latifolia
Salix planifolia
Salix paraleuca
Salix pedunculata
Salix amoena
Salix pellita
Salix pellita forma psila
Salix arbusculoides
Salix argyrocarpa

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New names are printed in **bold-face** type.

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V

FRAGMENTA PAPUANA

[OBSERVATIONS OF A NATURALIST IN NETHERLANDS NEW GUINEA]

BY

H. J. LAM

WITH TWO MAPS AND THIRTY-TWO TEXT-FIGURES

Translated from the Dutch by
LILY M. PERRY

PUBLISHED BY
THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY
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FOREWORD

Up to the beginning of the present century New Guinea, from a botanical standpoint, was largely a *terra incognita*. While some field work had been done, little intensive exploration had been attempted. This is manifest in Schumann & Lauterbach, Die Flora der Deutschen Schutzgebiete in der Südsee, 1900, covering the formerly German-controlled part (Kaiser Wilhelms-land), the western half of the Solomons, the Marshalls, Carolines, Palau, Mascarene, and Marianas Islands. They were able to record only 1560 species of vascular cryptogams and flowering plants from the vast area indicated. In the early part of the present century German botanists intensified their work on Northeastern New Guinea, while Australian, British, and Netherlands botanists increased their field activities in their territories. Finally, beginning in 1925, the Arnold Arboretum sponsored various expeditions to Papua, the Solomon Islands, and the New Hebrides. These collections have been greatly augmented by the material brought together by Mr. L. J. Brass, botanist on the three Archbold Expeditions to New Guinea, 1933–34, 1936–37, and 1938–39. On the last expedition Mr. Brass was assisted by Mr. C. Versteegh and Dr. E. Meyer-Drees.

Shortly after the close of the Nederlandsch-Indische-Amerikaansche Expedition, 1938–39, in furtherance of our work of identifying New Guinean plants here, Dr. Lily M. Perry began a translation from the original Dutch of Professor H. J. Lam's Fragmenta Papuana. The latter appeared as a series of articles in the Natuurkundig Tijdschrift voor Nederlandsch-Indië, 1927–29. Meanwhile, the present war spread rapidly and little-known New Guinea fell into enemy hands. As a concomitant of this war, the necessity for emergency foods has created a great demand for information regarding the poorly known floras of the Southwest Pacific region. Because Professor Lam's account of his experiences and observations on the vegetation of Netherlands New Guinea is very instructive, Dr. Frans Verdoorn, also a staff-member of the Arnold Arboretum, suggested that it might be helpful to have the translation published, and he in turn took up the matter with the Board for the Netherlands Indies, Surinam, and Curaçao, in New York. This Board not only endorsed his idea but also, through its office in Washington, made a liberal grant to the Arnold Arboretum to assist in covering the cost of publication. For this generous support we are particularly indebted to Dr. P. J. Honig.

Normally, permission to publish the translation would have been sought from the author. However, the representatives of the Government of the Netherlands East Indies, through the Board for the Netherlands Indies, Surinam, and Curaçao, have not only acted as sponsor by giving us permission to publish the translation, but, as mentioned above, have contributed materially to the actual cost. This authoritative group took the attitude that, through the medium of an English translation, the important data included in Dr. Lam's account would be more widely available, and through such a publication a real contribution would be made of which the general public could take advantage. Apart from the fact that Professor Lam's articles present an excellent picture of the terrain and its difficulties, as well as suggesting the possibility of subsisting in the lowland, if such necessity should arise, it must not be overlooked that at the same time a great deal of purely botanical information will be available which is now to be found only in a few of our libraries.—E. D. Merrill.

PREFACE

The Fragmenta Papuana by Professor H. J. Lam is, without doubt, one of the most important botanical publications on Netherlands New Guinea. The series consists of seven articles published as follows: I. Chronological survey of the Mamberamo Exploration in general and of the Expedition to Central New Guinea 1920–1922 in particular, Natuurk. Tijdschr. Nederl.-Ind. **87**: 110–130. 1927. II. Some meteorological data collected during the Central New Guinea Expedition 1920–1921, op. cit. **87**: 130–138. 1927. III. Impressions of the Lower Mamberamo Territory, op. cit. **87**: 139–180. 1927. IV. The Meervlakte and the foothills, op. cit. **88**: 187–227. 1928. V. The north slope of the Central Mountain Range, op. cit. **88**: 252–324. 1928. VI. Above the forest limits: Doormantop and its vegetation, op. cit. **89**: 67–130. 1929. VII. Land and people of the Dika and Toli Valleys, op. cit. **89**: 291–380. 1929. Appendix, op. cit. **89**: 381–385. 1929. The corrections following the appendix have been inserted in the places indicated. The original is abundantly illustrated with 93 figures. It was decided not to reproduce the halftones, but the majority of the drawings are included in this English version. The tables appended to Fragment VI have not been reproduced, since all the plants listed are discussed in the text.

Although the botanical information embodied in these articles was the primary objective of the author, and also ours, I cannot but express something of the pleasure I have derived from Professor Lam's delightful pen-pictures of the country and its inhabitants. The botanical enumerations and descriptions are interspersed with a vivid and living journal covering the year which he spent in New Guinea. The summaries of his impressions, the faithful recording of details, the intuitive appreciation of beauty so well expressed in scenes of nature, and the variety of his observations: all these lend color and interest to this work.

On account of the proximity of the regions explored by the van Overeem Expedition, of which Professor Lam was the botanist, and by the Nederlandsch-Indische-Amerikaansche Expedition (Richard Archbold Expedition, 1938–39), it seemed to be desirable, in handling the botanical collections of the latter, to obtain some idea of the content of the Fragmenta Papuana. Hitherto in our work together, Dr. Merrill has given me the benefit of the gist of short Dutch descriptions whenever the need arose; but he is much too busy to take the time to impart to me the content of such comprehensive articles. For this reason, obviously it was necessary for me to learn some of the fundamental principles of the Dutch language. In this it was my good fortune to receive careful and painstaking instruction from Mrs. J. A. C. Fagginger Auer. She also most graciously supervised about half of the translation. In the remaining parts Dr. Frans Verdoorn has been exceedingly generous and repeatedly helpful in unraveling complex sentences, as well as in explaining various Malayan words and other difficulties. Dr. Merrill has very kindly read the manuscript, and I am indebted to him for many useful criticisms and suggestions. The errors and omissions, of which I hope there are not too many, are mine alone.—
Lily M. Perry

FRAGMENTA PAPUANA[1,2]

[OBSERVATIONS OF A NATURALIST IN NETHERLANDS NEW GUINEA]

H. J. Lam[3]

with two maps and thirty-two text-figures

Translated from the Dutch by

Lily M. Perry

Introduction

The articles which I propose to publish consecutively under the above common title are taken from an extensive and hitherto unpublished manuscript. As botanist, I participated in the first part of the Mamberamo Expedition in New Guinea under the leadership of A. J. A. van Overeem, at that time Captain of the General Staff. Shortly after my return in January 1921, I began to work up my notes, and it was the end of 1924 before I completed the task. Through various and sundry circumstances, however, this work remained unpublished. It was late in 1926 before I set eyes on the manuscript again. Since it was written, much has been published on New Guinea and regarding our Mamberamo Expedition. Nevertheless, I think that there is enough of value in these notes to warrant their publication as Fragmenta Papuana. To that end the copy has been revised as necessary, utilizing the published literature to complete it.

The first article of the series is of an introductory nature and relates to the history of the Mamberamo Expedition in general and to that of the expedition of 1920–1922 in particular. The second article contains merely meteorological data which I assembled during the expedition. The remaining Fragments, which I hope will follow, relate to the vegetation, and each will consist of studies of the plant formations of the several regions visited, again with accessory small detailed maps, landscape sketches and photographs. Only one article in its principal content touches upon the field of ethnology; for that reason this will be published elsewhere.

The first two articles which follow are accompanied by two sketch maps which will be useful not only for Fragments I and II but also for the remaining

[1] Natuurk. Tijdschr. Nederl.-Ind. **87**: 110–130. 1927. Introduction and Fragment I.

[2] (Footnote taken from the Addenda). In a footnote at the beginning of Fragment V, it was stated that the "Indisch Comite voor Wetenschappelijke Onderzoekingen" rendered possible the publication of the "Fragmenta Papuana" in its original illustrated form. Through a regrettable oversight in the introduction to the first part of the Fragmenta, the fact was not mentioned that the Scientific Expedition to Central New Guinea 1920–1922 was organized and equipped by that Committee, the chairman of which was Lieut.-Gen. H. N. A. Swart, at that time Vice-President of the Council of the Netherlands Indies.

Other additions and corrections given at the end of Fragmenta VII are interpolated in their proper places in this translation.

[3] At the time of the publication of the translated articles, Prof. Lam's title was Assistant in the Herbarium of the 's Lands Plantentuin, Buitenzorg, Java; at present he is Director of the Rijksherbarium, Leiden, Netherlands.

MAP A

Legend

1. Tulband-bivak
2. Edi-bivak
3. Wand-bivak
4. Batavia-bivak
5. Kalong-bivak
6. Veen-bivak

N. B. The area limited by a border in the Central Region is considerably enlarged and given in greater detail in Map B.

parts. Map A (river bivouacs 1–6) gives a general view of the entire region; a part of it is enlarged in map B (land bivouacs 1–20).

I. Chronological survey of the Mamberamo Exploration in general [4] and of the Expedition to Central New Guinea 1920-1922 in particular

A. History previous to the Expedition 1920–1922.

1884. Voyage of the government steamship "Havik." The ship reached Havik Island, just upstream from the present Pionier-bivak.

[4] Cf. also: Verslag van de Militaire Exploratie van Nederlandsch-Nieuw-Guinee 1907—1915, uitg. Dept. v. Oorlog, 1920.

1900. Voyage of the steamship "Camphuijs" of the Koninklijke Paketvaart-Maatschappij to Havik Island.

1906. Voyage of the government steamer "Brak" to Havik Island.

1909. Voyage of the small government steamship "Pionier" (after which Pionier-bivak is named) 20 km. beyond Havik Island, and an additional trip of 15 km.[5] further by proa.

1909–1910. Franssen Herderschee Expedition.[6] This reached the Meervlakte for the first time and proceeded up the van der Willigen River. On account of the illness of many participants, this undertaking had to be discontinued at the beginning of the overland journey. The base was located first at Koetei-bivak on the van Gelder River, but later it was moved to the Old Pionier-bivak on the left bank of the Okten River a few hundred meters from its mouth. The altitude reached was 850 m. A small part of the Idenburg River was reconnoitered.

1910–1911. Moszkowski Expedition.[7] Two noteworthy journeys of Dr. Moszkowski, accompanied by a European preparator and a few natives. The first journey included an investigation of the mouth of the Mamberamo. Base: Franssen Herderschee's Pionier-bivak. Moszkowski was shipwrecked in the Edi Falls and lost all collections and equipment. On the second voyage he reached the Meervlakte, sailed up the van Daalen River, and finally for some days followed the overland route located by the Franssen Herderschee Expedition. On the return journey he was again shipwrecked. Although some entries in Dr. Moszkowski's publication indicate that he certainly visited most of the points which he describes, other passages leave one in doubt as to whether or not all statements are to be trusted. There seems to be some question as to whether or not both shipwrecks actually occurred. On the last part of his land journey he was accompanied by one Papuan. Moszkowski believed that he was within 40–45 km. of Carstensztop.

1911. De Wal Expedition. The old Pionier-bivak used as a base. Reconnaissance of the Idenburg River up to the great gap, including some tributaries.[8]

1913–1915. Oppermann Expedition. Reconnaissance of the van Rees Mountains and the coastal islands. The expedition explored the Idenburg and the Rouffaer Rivers and their source-streams.[9] The commander of the detachment, now sub-Lieutenant L. A. C. M. Doorman, prosecuted a bold and swift journey into the mountain-region, whereby he, starting from what we now call the Doorman River, ". . . November 21, 1914 . . . reached a mountain-summit 3800 m. high . . . (the present Doormantop), which . . . afforded a view of the drainage of the central chain." As a result of his observations he indicated the probability that the southern valleys were inhabited. This journey was the immediate forerunner [10] of the

1920–1921 van Overeem Expedition, which was followed by the

1921–1922 Kremer Expedition.

[5] Rouffaer, Drie opvaarten van de Mamberamo, Tijdschr. Kon. Ned. Aardr. Gen. XXVI (1909) p. 86—Rambonnet, De jongste opvaart der Mamberamo, ibid., p. 946.

[6] Dr. J. K. van Gelder, Verslag omtrent eene geologische verkenning van de Mamberamo-rivier op Nieuw-Guinee.—Jaarb. Mijnwezen in Ned. Indië voor 1910, XXXIX (1912), 87.

[7] Dr. Moszkowski, Expedition zur Erforschung des Mamberamo in Holländisch Neu-Guinea —Zeitschr. der Ges. f. Erdkunde, 1912, p. 271 and 365, 3 maps.

[8] De Wal, Verkenning der Idenburgrivier, ibid. XXIX (1912), p. 293.

[9] J. W. Langeler and L. A. C. M. Doorman, Nieuw-Guinee en de exploratie der "Meervlakte," 1913–1915—De Aarde en haar Volken (1918), pp. 141–208.

[10] Another journey of Doorman, undertaken on the same expedition, was similarly the precursor of the Ned.-Amerikaansche Expedition 1926; cf. footnote 9.

MAP B

Legend

1. **Prauwen-bivak**	altitude	110 m.
a. Casuarisnest	"	233 m.
b. A small summit east of it	"	162 m.
2. Moeras-bivak (Woud-bivak)	"	110 m.
3. Kremer-bivak	"	120 m.
4. Aalscholver-bivak	"	130 m.
5. **Brug-bivak**	"	240 m.
6. Steen-bivak (Bivak-Batoe)	"	425 m.
7. Cruciferen-bivak	"	840 m.
8. **Bivak G. Boetak**	"	1425 m.
9. First Parkieten-bivak	"	1750 m.
10. Beek-bivak	"	2430 m.
11. Uitzicht-bivak	"	3120 m.
12. **Radio-bivak**	"	3330 m.
13. Mos-bivak	"	±3000 m.
14. Bamboe-bivak	"	±2450 m.
15. Jachthut-bivak	"	±1900 m.
16. Second Parkieten-bivak	"	±1750 m.
17. **Dika-bivak**	"	±1250 m.
18. First Toli-bivak	"	±1300 m.
19. Second Toli-bivak	"	±1400 m
20. Panara-bivak	"	±1400 m.

N. B. The bivouac-names in bold type are those at which supply depots were established. Regular communications were maintained between the camps. Bivouacs 3, 13, and 15 were visited only on the return trip.

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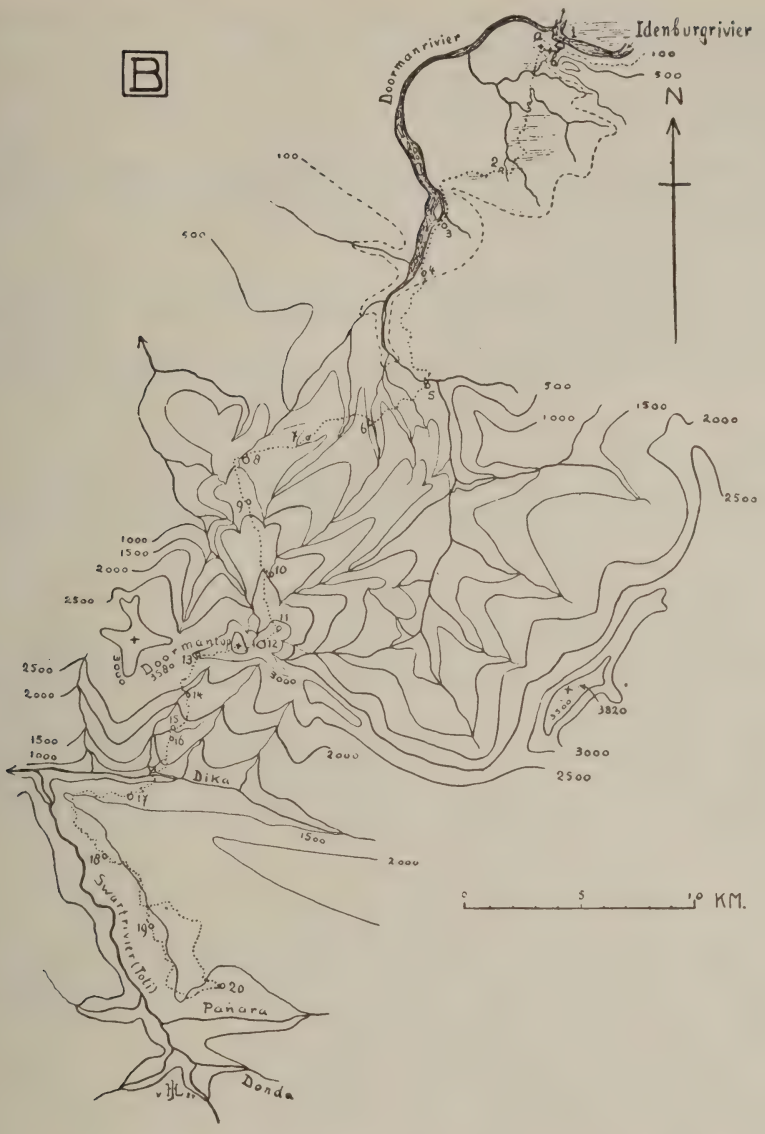
B. Van Overeem Expedition.

Personnel: A. J. A. VAN OVEREEM, Captain of the General Staff, Leader.
J. H. G. KREMER, "Captain-Lieutenant," in charge of the astronomical and meterological observations and the river-survey.
J. VAN ARKEL, Captain of the Infantry, commander of the supporting military detachment, responsible for reconnoitering the advance terrain, assisted by
K. DROST, First Lieutenant of the Infantry.
J. KOOIJ, First Lieutenant of Military Administration.
H. J. T. BIJLMER, Medical Officer, charged with organizing the medical service and with making anthropological observations.
A. TEN HAAF, Medical Officer, after a few months of illness, replaced by
H. DE ROOK, Medical Officer.
J. JONGEJANS, Controller of Inland Administration, the latter located at Boeloengan, responsible for the recruiting and the general supervision of the Dyak oarsmen, and for the ethnographic work.
Dr. P. F. HUBRECHT, Geologist.
Jhr. W. C. VAN HEURN, Zoologist to the Institute of Plant Pathology at Buitenzorg, Zoologist.
Dr. H. J. LAM, Assistant at the Herbarium and Museum for Systematic Botany of the 's Lands Plantentuin at Buitenzorg, Botanist.
P. DROOG, First Lieutenant of the Royal Engineers, Director of the Radio Division.
One mantri (Ajoeb) from the 's Lands Plantentuin at Buitenzorg



and one assistant-mantri (Siman) from the Herbarium at Buitenzorg as botanical helpers; two mantris (Eri and Djenung) from the Zoological Museum at Buitenzorg as helpers for the zoologist.

The last four joined the expedition later. In addition there were: one student-reconnoiterer, one sergeant-major administrator, five European sergeants, four native sergeants, five native corporals, 89 native privates, one European military correspondent, one European sergeant hospital-attendant, one European corporal hospital-attendant, one European private hospital-attendant, two Ambonese hospital-attendants, two native engineers (later placed under supervision of PAKCHWER, a European engineer), 163 convicts (of whom 10 were foremen), and 116 Dyak oarsmen. The radio section had its own personnel, which arrived later. Among them were one Adjutant non-commis-

sioned officer of the Royal Engineers, and two European corporal-signallers of the Royal Netherlands Marines.

Itinerary.

January 1920.

15. Departure from Soerabaja, at 4 o'clock in the afternoon, of the government steamers "Deneb," "Albatros," and "Koetei," the last commanded by Capt. Kremer.

21. Arrival at Amboina.

24. Departure from Amboina.

26. Arrival at Manoekwari. Capt. Kremer here transfers to the "Deneb." The "Koetei" has returned to Java.

31. Departure of the "Deneb" with the small government steamer "Pionier" in tow.

February.

1. Departure of the "Albatros" from Manoekwari.

2. At half-past eight in the morning the "Albatros" steams into the mouth of the Mamberamo; at half-past ten it is followed by the two others. At van Pee Island a new break of the river-course is found. Here at one o'clock the "Albatros" runs aground and just 24 hours later floats again.

5. The "Deneb" arrives at Pionier-bivak.

6. The "Albatros" and the "Pionier" arrive in front of the main bivouac.

7–8. Bivouac-building; observations near Scholten Island by Capt. Kremer.

12. First visit of Papuans.

13. Arrival of the "Edi," on which are Controller Jongejans with Dr. ten Haaf and the Dyaks. One of the last is seriously ill and dies the following morning. The remainder of the month is utilized with bivouac-building and proa-making. Many visits from the Papuans.

March.

8. Arrival of the "Albatros" with the remainder of the supplies for four months, a new group of convicts, and 10 Balinese oxen.

12. First reconnaissance of the rapids at Havik Island by Capt. Kremer, the Controller, and the Dyak chiefs Taman Lendah and Anji Nau. Water-level very high. The Dyaks advise against attempting to pass the rapids at this time. Moreover, an influenza-epidemic breaks out.

20. At 12 o'clock the first transport departs, consisting of two motor-boats and 12 proas, manned by 113 Dyaks, one infantry brigade, 40 convicts, and five engineers, under the leadership of Capt. van Overeem, Capt. Kremer, Contr. Jongejans and Dr. ten Haaf.

21. Their arrival below Marine Rapids. A proa with officer's baggage capsizes, and a European non-commissioned officer is saved by the Dyaks.

22. Both motor-boats pass the rapids, in the course of which a native helmsman falls overboard and is saved with difficulty by the Dyaks. Edi Rapids reached. During the high water-level the motor-boats cannot pass these. Additional cases of influenza.

26. The Dyaks bring additional supplies to the base. More influenza cases.

April.

4. Capt. van Arkel arrives with six proas. It has taken him five days, because of high water, to cover a distance later requiring only two. On March 20 a Dyak died of pneumonia. An attempt is made to open a trail overland to Edi-bivak, but this effort is abandoned after a few days.

7. A second Dyak transport, 13 proas, departs downstream.

15. This transport returns with 10 proas; seven sick Dyaks are left behind. Two convicts have died of influenza at Pionier-bivak.

21. The water has fallen so much that the motor-boats can be pulled over the falls.

23. Departure from Edi-bivak with two motor-boats and 19 proas, in which are the leader, Capt. Kremer, Capt. van Arkel, and in addition one European sergeant, 9 convicts, one Ambonese private (hospital-attendant), and 105 Dyaks.

25. One of the motor-boats loses its propeller.

26. Repair of the motor-boat. Day of rest. The Dyaks secure 100 kg. of fish from the river.

27. Passing of Batavia Rapids and arrival at the Meervlakte. Establishing of the new Batavia-bivak on the right bank of the river.

28. A transport of 75 Dyaks returns to Edi-bivak; others search for trees from which to make proas (length 17–18 m.; the ordinary proas are 10–12 m. long and about 80 cm. broad; under favorable circumstances they carry, in addition to five Dyak oarsmen and three passengers, a load of 200 to 250 kg.).

May.

1. The transport arrives from Edi-bivak.

5. The other occupants of the Edi-bivak arrive at Batavia-bivak. Among them are Controller Jongejans and Dr. ten Haaf. Two proas are ready for loading.

8. All but seven Dyaks return with 15 proas to Pionier-bivak.

9. Departure for the south; each motor-boat tows a loaded proa. The crew consists of five staff-members, 12 native fusileers, 17 convicts, seven Dyaks, and five engineers, together with provisions for a month. Both river-banks are inundated. Some nights Kalong-bivak is under water.

11. Establishment of Prauwen-bivak on the high bank nearest to where the Idenburg River leaves the mountainous area 1.5 km. upstream from the mouth of the Doorman River. The following days are spent in bivouac-building and in establishing friendly contacts with a small Papuan tribe from a distant region.

14. The leader and Capt. Kremer go with the motor-boats to Batavia-bivak. It appears that the 105 km. can be covered in eight hours.

18. Arrival of the transport. The "Edi" appeared May 9th, with a light load, 62 days after the arrival of the previous boat. On the night of May 10–11 Pionier-bivak lay partly under water. A few dysentery cases; much malaria.

28. The water has dropped very quickly in the past few days.

29. First reconnaissance into the interior. The party, consisting of Capt. van Arkel and Capt. Kremer with four fusileers and six convicts, departed on the 24th and returned today. They proceeded 10 km. from Prauwen-bivak along the very broad (400 m. wide) freshet-bed of the Doorman River, the stream not being navigable by regular transport. They did not locate Doorman's trail, since he commenced his overland journey from the left bank of the river.

30. A space is cleared for an outlook on the top of Casuarisnest.

June.

5. The transport, under the direction of Controller Jongejans, starts down river, carrying Dr. ten Haaf, who is seriously indisposed. Both the leader and Capt. Kremer suffer attacks of fever.

13. Arrival of the zoologist and botanist at Pionier-bivak with the "Albatros."
14. Second reconnaissance by Capt. van Arkel.
15. Third reconnaissance by Capt. van Arkel.
17. In the night of 17–18 a slight earthquake is felt.
19. Departure of the fourth reconnaissance party under Capt. van Arkel, with four privates and four convicts. Purpose: to find a suitable place for crossing the Doorman River.
23. Return of the patrol. No place in the river narrower than 80 m. is found.

July.

2. Fifth reconnaissance under Capt. van Arkel and the leader. Capt. Kremer departs for downstream to bring up the third motor-boat. The patrol finally has found a place 16 km. distant from Prauwen-bivak where the Doorman River is 35–40 m. wide. Capt. van Arkel has remained behind to build a rattan bridge and to examine the lay of the land.
22. Arrival of the geologist at Pionier-bivak with the "Albatros."
23. Capt. van Overeem arrives from upstream at Pionier-bivak.
28. Capt. Kremer, with Lieut. Kooij and Dr. Hubrecht, makes a two-day reconnaissance of the Marine Rapids, with the objective of bringing up the third motor-boat.

August.

1. Departure of Dr. Bijlmer and Contr. Jongejans for Prauwen-bivak. Capt. Kremer, the zoologist, and the botanist suffer from various maladies.
8. Departure of the geologist and botanist for Prauwen-bivak. In Batavia-bivak they meet Contr. Jongejans and Dr. Bijlmer, who have been waiting there for the next transport, on account of Contr. Jongejans having had an attack of malaria.
14. Arrival at Prauwen-bivak of the four previously mentioned members of the expedition.
16. Communication from Capt. van Arkel that he has not yet located Doorman's old trail, and that he has established a supply-depot (just in front of what is later Cruciferen-bivak) at about 20 km. from Prauwen-bivak and at about 800 m. altitude, after a trip over very difficult mountain-terrain. Two Chinese convicts of the last mountain-transport have been missing since Aug. 15.
20. Return on a small raft of the missing convicts.
28. A sad day in the annals of the expedition. The leader, Capt. Kremer, and the zoologist arrive at Prauwen-bivak with the report that the "Edi" is in peril, having been grounded on an uncharted rock close to Scholten Island since the 16th. It is feared that she will break up. The cargo and the crew have been landed on the beach. With this ship the radio equipment, under Lieut. Droog, has arrived, in addition two European corporal-signallers of the Royal Netherlands Marines, an adjutant non-commissioned officer, and Pakchwer, the European (Russian) supervisor of engineers. Further, on account of the low water-level, the third motor-boat is stranded below the Batavia Rapids. The saddest event of the day, however, is the death of a European sergeant, commander of Brug-bivak, who has committed suicide. The following day the leader and Dr. Bijlmer assist in the burial.

September.

2. The setting up of the radio equipment at Pionier-bivak. The reception appears to be successful; the dispatch offers many difficulties. Return of the

leader and the doctor from Brug-bivak. They bring the news that Capt. van Arkel has found Doorman's trail (just in front of what is later Goenoeng Boetak-bivak) and along that route they have reached a higher altitude. Four escaped convicts are recaptured at Batavia-bivak.

5. The radio equipment is tested at Prauwen-bivak. A special radiogram is received from a ship in Torres Strait near Australia, and Amboina, Bandung, Hongkong, and Cavite (Manila) stations are heard.

6. The advance-guard arrives, whereupon the leader, Capt. Kremer, and the geologist proceed with a transport of 90 convicts into the mountainous region. In the afternoon we are visited by 21 bird-hunters, 2 Chinese and 19 Papuans, from the coast. They have left Hollandia and reached the Idenburg River overland, living by hunting and fishing. Then they have constructed proas, and, in hope of our assistance, have come down the river.

10. Arrival of Lieut. Droog at Prauwen-bivak. He brings the report that the "Edi," with a damaged boiler, floated on August 31st and got away under its own power. The radio equipment does not appear to be powerful enough to receive dispatches from Amboina.

12. Contr. Jongejans proceeds downstream to recruit Dyaks as carriers for the overland journey.

18. Departure of the botanist for Brug-bivak, also of Lieut. Drost, who in the meantime has arrived at Prauwen-bivak. A week later the zoologist follows. After Lieut. Drost returns, on the 28th, the zoologist and the botanist proceed to Goenoeng Boetak.

October.

1. News is received from the vanguard that it arrived on Sept. 16 at Radio-bivak, where it met Capt. van Arkel. In this part of his report the leader proposes to introduce the names *Doormantop*, *Doorman River*, and *Swart River*.

9. A later communication mentions that the leader, before he descends into the valley, will leave a supply of provisions at Radio-bivak. Capt. van Arkel has done some scouting to get an idea of the best route to follow.

10. Arrival of the first Dyak transport at Goenoeng Boetak. It has a crew of 54, with Contr. Jongejans, Dr. Bijlmer, and Lieut. Droog. The purpose: to proceed inland and then to continue collecting at higher altitudes. The botanist joins this transport; the zoologist remains at Goenoeng Boetak.

16. Arrival of the transport at Radio-bivak. The crew consists of the four mentioned staff-members, two Dyak chiefs, 52 Dyak carriers, one European sergeant, one European corporal-signaller of the Marines, and 10 convicts.

17. The botanist finds a handkerchief which belonged to Lieut. Doorman.

18. Departure of the vanguard for the valley. This consists of the leader, Capt. Kremer, the geologist, Capt. van Arkel, Dr. Bijlmer, and Contr. Jongejans, one European sergeant, one Ambonese student-reconnoiterer, one Menadese private (hospital-orderly), 5 native fusileers, 26 Dyaks, and 20 convicts. The botanist and the Radio-Lieutenant remain at Radio-bivak. The latter, with little material, reconstructs the radio equipment, with the result that all important news is quickly received.

22. Arrival of the vanguard in the Dika valley and first friendly contact with the Timorinese people. A food-shortage develops at Radio-bivak.

26. Messages arrive from the valley; among other things is the first news-item that is to be sent out, announcing the discovery of the Timorini.

27. In the evening at half-past ten there is a total eclipse of the moon.

29. In consequence of the dire food-shortage, all who are not strictly necessary for bringing up food or for leadership must leave the Radio-bivak. Among them is the botanist, who proceeds to Goenoeng Boetak, where the food-supply is sufficient for the time being. A speedy runner is sent to the valley to carry word to the vanguard of the situation at Radio-bivak. Also unnecessary men at Goenoeng Boetak are sent farther downstream; the rations of the active carriers are restored to the old standard and those of the people in camp are curtailed more than half.

November.

1. A transport of Dyaks, 16 strong, proceeds from Goenoeng Boetak; three convicts, one private, and four native helpers (three of the zoologist's and one of the botanist's) go downstream. Communications from the vanguard indicate that a fairly serious incident has occurred in connection with the Dyaks' stealing of a Timorinese pig. This event, however, turns out all right, at the cost of several chopping knives.

3. Two Dyaks, speedy runners, arrive, coming in a day from Radio-bivak to Goenoeng Boetak with telegrams to be sent regarding the continuation of the expedition, since the goal, Wilhelminatop, has not been reached.

4. These communications are sent through to Prauwen-bivak by relays of runners, so that in three days from Radio-bivak telegrams can be in Prauwen-bivak.

5. Arrival of Capt. van Arkel and Lieut. Droog at Goenoeng Boetak. A strong extra transport (among whom are 14 Dyaks) departs downstream; the zoologist, who, except for a few days at Beek-bivak, has collected continuously at Goenoeng Boetak, joins it.

6. Arrival of Capt. Kremer at Goenoeng Boetak.

7. Departure of Capt. Kremer, Capt. van Arkel, and Lieut. Droog for Prauwen-bivak. Through the measures taken, the botanist secures an opportunity to proceed further inland. Up to now the supply-line has stood as follows:

1	Amboina – Pionier-bivak	Once a month, sometimes less, by government steamer.
2	Pionier-bivak – Batavia-bivak	50 Dyaks with 10 proas, 3½ days up, 1½ days down, 1 day rest.
3	Batavia-bivak – Prauwen-bivak	3 motor boats towing 2 loaded proas, 3 days up, 1 day down.
4	Prauwen-bivak – Brug-bivak	70 (later 85) convicts, 3 days up, 2 days down, 1 day rest.
5	Brug-bivak – Goenoeng Boetak	45 (later 60) convicts, 2½ days up, 2½ days down, 1 day rest.
6	Goenoeng Boetak – Radio-bivak	23 Dyaks (among these 1 chief), 3½ days up, 2½ days down, 1 day rest.
7	Radio-bivak – Dika-bivak	11 Dyaks (among these 1 chief), 3 days down, 1 day rest, 3 days up.

8. Departure of the botanist, with a mantri, a convict, and 3 Dyaks, to Radio-bivak, with an interim of four days at Beek-bivak. Here he obtains word that the last Dyak transport from Radio-bivak will depart the 17th for the valley; he wishes to join this group.

14. Arrival of the botanist at Radio-bivak. On account of the breaking of a tree supporting it, the rattan bridge of Brug-bivak falls into the stream. A new one is made.

17. Departure of the botanist with the Dyak transport for Dika-bivak.

18. Arrival of the botanist at Dika-bivak.

21. Departure of the vanguard to make a 5-day journey through the main valley.

24. The most southerly point (Panara) is reached.

27. Departure of the vanguard from Dika-bivak.

December.

5. The vanguard again at Prauwen-bivak. A convict, obviously insane (with a persecution complex), after stabbing a Timorinese soldier in the back as he is standing on guard, fled with a proa some days ago and has apparently perished.

6. Departure of the leader, Contr. Jongejans, and the zoologist for Pionier-bivak. There telegrams are exchanged with Java as to whether or not to continue the expedition.

25. Departure of the botanist from Prauwen-bivak.

28. His arrival at Pionier-bivak.

January 1921.

7. The radio equipment is successful in reaching Amboina for the first time with a dispatch. Packing of the collections.

10. Arrival of the "Gemma," escorted by the "Pionier," but only the latter comes up to Pionier-bivak; the "Gemma" remains below the dangerous rock near Scholten Island. This boat has brought the ethnographer, Dr. P. Wirz, and also the report that, in eventually continuing the expedition, Capt. Kremer will be made the leader. The contract with the Dyaks has expired; they have to be recruited anew.

The water-level, which has remained very low, now begins to rise quickly as a result of the rains in the mountains. Arrival of the geologist, who has lost some equipment in the Edi Valley.

12. Departure of the "Gemma," with Capt. Kremer, who is going to Amboina to consult with the Indian Committee by wire. The zoologist, the botanist, and the Radio-Lieutenant also depart. The "Pionier" remains provisionally on the river.

C. Kremer Expedition.

European Staff: J. H. G. KREMER, "Captain-Lieutenant," leader.
J. VAN ARKEL, Captain of the Infantry, Commander of the covering detachment.
K. DROST, First Lieutenant of the Infantry.
A. ZIJLMANS, First Lieutenant of Military Administration.
H. DE ROOK, Medical Officer.
Dr. P. F. HUBRECHT, Geologist.
Dr. P. WIRZ, Anthropologist-Ethnologist.

Itinerary.[11]

January–September.

Preparation and transportation of supplies to the depots in the mountains, particularly to that in Dika-bivak. Reconnaissance from there to the south.

October.

10. Earthquake, felt at Dika-bivak at 11:45 A.M., direction north-south, lasting 30–45 seconds. In the neighborhood great landslips occur, from the results of which the Dika is hidden for some hours.

12. Arrival of the leader and the geologist, Dr. Hubrecht, with 34 Dyaks.

16. Departure of the staff with 41 Dyaks and 32 Timorinese carriers toward the south. As a medium of exchange *tigalèhs* (cowrie shells, *Cypraea moneta*) are used; with these, goods and services are purchased.

17. Remain in Panara-bivak, where we have many visitors; a number of carriers are recruited and a shooting match is organized.

18. Departure for Donda, the next lateral valley after the Panara. The Timorinese carriers receive a day's wage of one *tigalèh*. This camp is used on September 14–15 by a reconnaissance patrol.

20. March to the Koeboe, a tributary on the left side of the Swart River. No Timorinese carriers are used. In the Kampong Doendoe renewed friendships are established, and we hear the first report about a dense population in the Baliem valley. From here on the advanced division will work in entire independence, this guaranteeing a large freedom of movement, but also, as a consequence of the food-situation, only limited time is available. Much food, however, can be had from the people. Lieut. Drost remains behind for the time being.

24. Departure for Kampong Noega in the Koeboe Valley. The Timorini carry the loads without pay.

25. Departure for Kampong Tamak, altitude 1750 m.

November.

1. The departure for Kampong Noreagobak, in the extreme south of the Koeboe Valley.

4. Reconnaissance by the leader of Mount van Arkel (3100 m.), which was visited by Capt. van Arkel on September 18. Also a few shorter trips are taken in the neighborhood. The natives make many visits.

8. The watershed between the Swart River and the Baliem Valley is crossed. Bivouac on the Djoe, a tributary of the Baliem. New friendships established. Also here an attempt is made to retard the expedition by claiming that the Baliem people will be hostile.

10. The Baliem reached. On its banks in a Kampong at 2400 m. altitude a bivouac is made the 11th, close to the Tora, an isolated rock which rises about 400 m., almost perpendicularly above the river. Friendly relations are quickly established.

14. The entire vanguard is now combined at this bivouac. Lieut. Drost remains behind in Tora-bivak to guard the supplies.

17. The Baliem is crossed by a very strong suspension bridge, and on the opposite side native carriers are recruited; they proceed to Tora-bivak to bring

[11] Adopted from the synopsis in the "Indische Gids," 1922, p. 550 et seq., and from verbal information.

supplies. Thus Lieut. Drost can follow the same day. Bivouac on a ridge at 2800 m.

18. Pieremeh, a small tributary on the right of the Baliem, is reached. The territory from here to Wilhelminatop is uninhabited, but a good path leads over the Central Chain towards the south, where the Pesechems live. The distance still to be covered is 30 km. Lieut. Drost again remains behind to guard the supplies.

19. Departure of the leader, the geologist, and Capt. van Arkel to the south. A marshy area at 3800 m. altitude is crossed. Wamgimeh, the faithful native guide, and 10 clansmen accompany them as carriers.

20. After crossing a ridge at 4100 m. altitude, the upper Baliem is reached, on the left bank of which at 3200 m. a bivouac is made. In the afternoon 10 natives arrive with 3 pigs and many sweet potatoes and much sugar cane; they were sent by Lieut. Drost.

21. The Baliem is followed upstream. Bivouac is made on the south margin of the upper Baliem plain. This is the high plain which Franssen Herderschee saw from Wilhelminatop in 1913.[12]

22. With the help of the native carriers the Wamena is reached. From Wilhelminatop the stream flows towards the east and perhaps does not belong to the Baliem system.

23. A large number of natives return, promising to bring foodstuffs. Rest a day here.

24. Wamgimeh returns with a number of Dyaks. The vanguard leaves for the south. Bivouac on one of the tributary sources of the Wamena.

25. A very good trail is followed. It appears later to be the path that traverses the Central Range from north to south. Bivouac at a forest margin.

26. Reconnaissance of the north side of the Central Chain.

28. Arrival of Dyak carriers with supplies.

29. Departure for a pass which is observed to cross the ridge in an easterly direction. Here are met a number of old friends, who were supplied with sweet potatoes by a group whom they have unknowingly followed.

30. Scouting the terrain, in which everywhere one is surrounded by patches of snow.

December.

2. Arrival of Lieut. Drost, who brings sweet potatoes and five pigs. Here the altitude is 4150 m. (Last bivouac except one).

3. A small group, including the entire staff, advances and bivouacks at 4450 m. (Koude-bivak). Heavy snow some nights. Wilhelminatop lies to the east of this bivouac.

4. Through a narrow crevice, and after a difficult ascent of 300 m., the last easy climbing is reached. A large snow field is crossed. The small glacier appears to be vanishing. Later an ice block of about 100 cu. m. is observed. It perhaps was dislodged by the earthquake of October 10th. At 10:30 the highest point (4750 m.) of Wilhelminatop is reached. Here is found the heap of stones erected by the Franssen Herderschee Expedition on February 21, 1913. The record placed therein is partly legible. Here a statement of the

[12] Cf. A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea (Uitg. Mij. Goede en Goedkoope Lect., A'dam, z. j.), p. 169, and P. F. Hubrecht, Maatsch. t. Bevorder, v. h. Nat. Onderz. d. Ned. Kol. Bull. no. 68 (1913), p. 46.

personnel of this party is added: Capt. Kremer, Capt. van Arkel, Lieut. Drost, Dr. Hubrecht, one native student-reconnoiterer, 22 Dyaks, and four convicts. Bivouac today at 4300 m.

8. Lake Habbema, already observed from Wilhelminatop, is reached. It is 700 m. wide and 6 km. long (east to west) and lies at an altitude of 3000 m. The depth is 2–3 m.; the lake apparently has no drainage. Many Papuans come to visit us here.

10. The Baliem is again reached.

17. The ridge of Mount van Arkel is passed (2700 m.) and the summit again crossed. Everywhere the natives celebrate with feasts.

20. Hundreds of visitors come to Doendoe to take leave, during which visits 13 pigs are killed.

29. Arrival at Prauwen-bivak.

January 1922.

1. Arrival at Pionier-bivak.

II. Some meteorological data collected during the Central New Guinea Expedition 1920-1921 [1]

A. Hygrometer observations.

The Royal Magnetic and Meteorological Observatory at Weltevreden lent me a set of two thermometers, one of which was arranged for use with wet bulb. In this the bulb was wrapped with a small piece of cotton, the free end hanging down into a can of water. The readings were corrected according to the tables appertaining to each instrument, and the relative humidity was determined by consulting Neumayer's table (Anleitung zu wissenschaftliche Beobachtungen auf Reisen). The numbers of the observation-stations agree with those on maps A and B. Pionier-bivak is not numbered; Prauwen-bivak appears only on map B. In the tables, t means temperature of the dry bulb thermometer, t^1 that of the wet bulb thermometer, all in degrees Centigrade. [Only a summary of the observations is given here; included under each caption are the highest and lowest readings.]

Table I

Observations at Pionier-bivak (position: in the shade in the cleared bivouac-area): 22 observations; altitude 60 m.; date, August 2–6, 1920; time, various hours from 6 A. M. to 9 P. M.; t 24–30.8°; t^1 23.4–26.2°; relative humidity 64–94; weather, rain twice, other records blank.

Mean t 26.3°. Mean relative humidity 86.

Observations at Goenoeng Boetak-bivak, Map B, 8 (position: in the forest under a small shed, about 1.5 m. above the ground): 29 observations; altitude 1424 m.; date, October 1–11, 1920; time, various hours from 6 A. M. to 8 P. M.; t 15.8–20.5°; t^1 15.8–20.2°; relative humidity 89–100; weather variable, one observation dry, one sunny, two bright, the others cloudy, misty (foggy), and rainy.

Mean t 18.3°. Mean relative humidity 98.4.

Observations at Radio-bivak, Map B, 12 (position: open terrain above the forest-limit; under small shed about 0.5 m. above the ground): 21 observations; altitude 3332 m.; date, October 19–27, 1920; time, various hours from 7 A. M. to 6 P. M.; t 8.4–20.8°; t^1 7.4–15.1°; relative humidity 51–100; weather, six observations clear or sunny, the others foggy or rainy.

Mean t 12.2°. Mean relative humidity 86.5.

Maxima and minima.

Observed maximum: 34° (April 28, 1920) (33.5° on June 7 and 8).

Observed minimum: 20.5° (May 10 and 11, 1920).

Lowest day-maximum: 28° (February 26, 1920).

Highest day-minimum: 24.5° (five times between February 20 and June 26, 1920).

B. Barometer observations.

The Meteorological Observatory at Weltevreden supplied me with an aneroid barometer (no. 9582), chiefly for use in making altitude-observations. A few

[1] Natuurk. Tijdschr. Nederl.-Ind. **87**: 130–138. 1927.

times I verified these observations with a hypsometer, of which a few records are noted below. All values found have been corrected by standard methods. In the calculations the barometer-readings are in mm., the thermometer-values in 5's. [For convenience in summarizing the tables which follow, Roman numerals are used to designate the captions thus: I, observed at; II, date; III, hour; IV, aneroid reading in mm.; V, temperature in degrees Centigrade; VI, altitude in m.; VII, remarks.]

Table II

I, Pionier-bivak, 23 records; II, August 2–6, 1920; III, various hours between 6 A. M. and 10 P. M.; IV, 754–757.8; V, 24.4–29.8°; VI, 46–94; VII, average, 71 m.

The above data were obtained with the aneroid barometer which had been checked by the Observatory. Later I readjusted the instrument with reference to the hypsometer (see under Prauwen-bivak); the subjoined numbers are since recorded at Pionier-bivak.

Table III

I, Pionier-bivak, 4 records; II, January 4 and 5, 1921; III, 10 A. M. to 4 P. M.; IV, 751.8–755; V, 25°; VI, 81–116; VII, average, 99 m.

For a control, the aneroid barometer was checked on the return journey at Makassar harbor. The following record was made:

Table IV

I, Makassar harbor, 2 records; II, February 1 and 4, 1921; III, 9 A M. and 4 P. M.; IV, 758.8 and 757.9; V, 25°; VI, 35 and 46; VII, average, 41 m.

The last two values give an average of 41 m. altitude, the data of the table above (Table III) 99 m., the difference indicating an error in the instrument; subtracting this error from the values found for Pionier-bivak (Table III), we obtain 58 m. This number agrees fairly well with the average value obtained in Table II, i. e. 71 m. On the basis of these observations, I think that the altitude of Pionier-bivak must be placed at about 60 m.

The observations in the van Rees Mountains, the Meervlakte, and the Central Mountain Region follow:

Table V

I, Tulband-bivak, Map A, 1; II, August 8, 1920; III, 3 P. M.; IV, 755; V, 25°; VI, 81.

I, Edi-bivak, about 8 m. above the river, Map A, 2, three records; II, August 9 and 10, 1920; III, 6 A. M.–6 P. M.; IV, 754.6–757; V, 25°; VI, 58–81; VII, average, 71 m.

I, Wand-bivak, Map A, 3, two records; II, August 8, 1920; III, 4 p. M. and 9 P. M.; IV, 752.1–756.1; V, 25°; VI, 69–116; VII, cloudburst beginning, cloudburst over.

I, Batavia-bivak, Map A, 4, four records; II, August 11, 1920; III, noon–8 P. M.; IV, 752.2–754.2; V, 25°; VI, 92–116; VII, average, 101 m.

I, Kalong-bivak, Map A, 5, two records; II, August 12, 1920; III, 2 P. M. and 5 P. M.; IV, 752.2 and 752.9; V, 25°; VI, 104 and 116.

I, Veen-bivak, Map A, 6, one record; II, August 13, 1920; III, 4 P. M.; IV, 750.9; V, 25°; VI, 127.

I, Prauwen-bivak, Map B, 1, ten observations; II, August 15–17, 1920; III, 7 A. M.–10 P. M.; IV, 751.5–754.0; V, 24.2–29.3°; VI, 92–118. After these records were made the aneroid barometer was set at 754.0 (reading of the hypsometer), so that this instrument in the future was read without correction; 17 more records were made at this station, of which two check or control readings on the hypsometer. II, August 17–25, 1920; III, 7:30 A. M.–10 P. M.; IV, 750.1–754; V, 26–30°; VI, 92–153; VII, average, 112 m.

I, Casuarisnest-top, Map B, 1a, one record; II, —; III, 10 A. M.; IV, 741.7; V, 25°; VI, 233.

I, Summit east of Casuarisnest, Map B, 1b, one record; II, —; III, 10:30 A. M.; IV, 747.6; V, 25°; VI, 162.

I, Brug-bivak, Map B, 5, 23 records; II, September 20–26, 1920; III, 6 A. M.–8 P. M.; IV, 740–744; V, 23–27.5°; VI, 209–268; VII, heavy rains in the evening of the 25th and the night and morning of the 26th; average, 239 m.

I, Batoe-bivak, Map B, 6, four records; II, September 28, 1920; III, 10 A. M.–7 P. M.; IV, 724.8–727.2; V, 24.1–26.4°; VI, 412–436; VII, average, 424 m.

I, Cruciferen-bivak, Map B, 7, four records; II, September 29, 1920; III, 12:30–6 P. M.; IV, 691.4–693.8; V, 23.5–25.3°; VI, 818–856; VII, average, 840 m.

I, Goenoeng Boetak-bivak, Map B, 8, 22 records; II, September 30–October 11, 1920; III, 7 A. M.–8 P. M.; IV, 644–648.6; V, 20–23°; VI, 1382–1448; VII, average, 1424 m.

I, First Parkieten-bivak, Map B, 9, three records; II, October 13, 1920; III, 11:30 A. M.–8 P. M.; IV, 620.8–622; V, 18.4–20.4°; VI, 1647–1747; VII, average, 1752 m.

I, Beek-bivak, Map B, 10, five records; II, October 14, 1920; III, noon–9 P. M.; IV, 570.9–572.8; V, 15.4–18.4°; VI, 2412–2453; VII, temperature of stream-water, 13°; average, 2432 m.

I, Uitzicht-bivak, Map B, 11, four records; II, October 15, 1920; III, 2–8:30 P. M.; IV, 528.4–529.2; V, 12.8–19.6°; VI, 3087–3157; VII, average, 3118 m.

I, Radio-bivak, Map B, 12, 18 records; II, October 16–26, 1920; III, 6 A. M.–11 P. M.; IV, 512.3–516.4; V, 8–21°; VI, 3314–3406; VII, average, 3332 m.

I, Doormantop, three records, one hypsometer reading, the other two aneroid; II, October 22, 1920; III, 9:30 and 9:45 A. M.; IV, 496.6–499.0; V, 15–16.5°; VI, 3581–3615.

I believe that the altitude of Doormantop must be accepted as about 3580 m.

III. Impressions of the Lower Mamberamo Territory [1]

In this and the following articles of Fragmenta Papuana which are concerned with the flora and the vegetation of the regions I visited in New Guinea, I have made use of the published botanical literature in which parts of my collection are elaborated (Nova Guinea vol. 14, Botany, book 1, 1924, and book 2, 1926). A list of the articles now published concerning the van Overeem and Kremer Expeditions will be added at the end of the Fragmenta series.

Where possible, therefore, plant names published in these articles are recorded. However, to obtain later a more complete picture of the vegetation, the numbers of my collection with preliminary determinations as well as undetermined numbers in sequence, wherever feasible, are also given. By this means, workers interested in this region will be enabled to add the scientific names when these numbers appear in the literature.

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When Dumont d'Urville, exactly a hundred years ago (Aug. 1827), sailed with his ship the "Aştrolabe" along the northern coast of New Guinea, he surmised from the strong discoloration of the sea-water that he was then in the neighborhood of the mouth of a large river. Later he wrote about it as follows:[2]

"A huit heures [August 16] l'eau de la mer prenant sur notre route une teinte verdâtre, j'envoyai le petit canot pour sonder sur cet espace. Il ne trouva point de fond a cinquante brasses, et je dirigeai la corvette au milieu de cette bande décolorée. A dix heures et demie un nouveau changement de couleur bien plus marqué se montra partout devant nous à une demi-encâblure de distance. Cette fois l'eau était tout-a-fait jaunâtre et bourbeuse . . . . . ; à onze heures nous donnâmes tout au travers de ces eaux décolorées, et nous traversâmes plusieurs lits de courans très-rapides et très-bruyans. Une quantité de branches d'arbres, de fruits détachés et de débris de plantes . . . . . flottai(en)t à la surface des eaux. A onze heures et demie, dans l'endroit où leur teinte était la plus fangeuse, l'eau que nous puisâmes n'etait plus que très légèrement saumâtre. Toutefois, en ce lieu même, nous n'eûmes pas fonds par cinquante brasses . . . . . .

"Je regardai donc comme un fait positif que ces eaux provenaient de quelque rivière considérable qui se décharge dans la mer sur cette partie de la côte. Bougainville observait le même fait au même endroit, et en tira la même induction. Précisément dans cette partie, la terre de la Nouvelle Guinée forme une pointe basse et fort avancée en mer (pointe d'Urville). Tout porte à croire que cette pointe a été formée par les attérissemens d'un torrent considérable."

In conclusion, just a little further, " la bande des eaux fangeuses n'a pas moins de dix ou douze milles de largeur, ce qui annonce une dimension considérable pour le fleuve qui les produit . . . . . .

"A cinq heures cinquante minutes du soir, nous traversâmes un fort remoux, et rentrâmes enfin dans la Mer bleue."

[1] Natuurk. Tijdschr. Nederl.-Ind. 87: 139–180. 1927.
[2] Dumont d'Urville, Voyage de la Corvette l'Astrolabe, IV (1832, Paris).

Meanwhile, as we have seen in the first Fragment, it was 1884 before the country was penetrated along this waterway for the first time, and February 1910 before the real interior, the Meervlakte, was reached. In June 1920 my traveling companions and I had the privilege of appropriating the words of Dumont d'Urville for our own, and of approaching the mouth of the Mamberamo. I shall insert here a little information about the mighty river, which, in spite of its swiftness, is still the only good trade-route between the coast and the interior of northern New Guinea.

With the Sepik (Kaiserin-Augusta River), the Mamberamo is one of the largest streams of the territory. The data available concerning this river are still very meager and do not amount to more than mere guesses, but, notwithstanding, they give us some idea of its size. The Mamberamo provides the drainage of a tropical high mountain-range almost 500 km. long and about 100 km. broad. This territory, where the rainfall is very important and on the average amounts to surely a few meters per year, is extended by the district to the north of it, which also drains mostly by way of the river, giving a drainage-area of 100,000 sq. km., roughly estimated. In looking over the short list given below, wherein the Mamberamo is compared with the Amazon and the Rhine, it is helpful to recall that the first-mentioned river possesses two about equally worthy tributaries, the van der Willigen River and the Idenburg River. The length is measured on the last named tributary.

	Rhine	Mamberamo [3]	Amazon [4]
Length in km.	1320	900	5500
Drainage-area in sq. km.	224,000	100,000	7,000,000
Solid materials carried toward the sea in kg. per year	2–5 thousand	15.1 thousand	1000–2300 thousand
The same per year per sq. km.	15,000	150,000	200,000
Average reduction of land per year in cm.	0.006	0.06	0.08
Capacity (water conveyance) in cu. m. per second	240	10,000	120,000
The same in cu. km. per year	7.6	315	3780

From these figures the great difference is evident, on the one hand, between the two tropical rivers themselves, and on the other, between these and a temperate zone river. This shows the enormous quantity of solid materials transported by tropical rivers. Here also is affirmation that, through vigorous erosion resulting from heavy rainfall, this territory diminishes in height ten times as rapidly as western Europe, namely 6–8 cm. in a century. Furthermore, we see that the Rhine, although longer than the Mamberamo and with more than twice as large a drainage-area, conveys 1/40 as much water, and that the Amazon, with 70 times as large a drainage-area, conveys only 12 times as much. The large capacity of the Mamberamo is in concordance with its comparatively great depth. In the lower course of the river, the channel is 15–18 m. deep, and near the Edi Rapids depths of 40 m. have been sounded, but in the relatively narrow passage in front of Prauwen-bivak 1920–1922 only 20 m. was sounded. Passing from the upper into the middle course of the river, one finds a long narrow gap, 9 km. long and 50–75 m. broad, through which the water flows with great force, and above the cleft, freshets make a difference

[3] The figures given in the table for the Mamberamo are adopted from van Gelder (l. c. 91).

[4] K. Braak, Waar blijft het Amazone-slib? Een geografisch probleem—De Natuur Jaarg. 43, No. 1, p. 21.

of 40 m. in the height of the water-level. Likewise the great velocity of the stream causes difficulty in navigating the river. At the mouth the current is still 3.5–5.5 km. per hour. As a result the tide can never enter within the estuary, and this in turn has a great influence on the flora of the river-banks.[5] At Pionier-bivak, situated 180 km. from the coast at an elevation of 60–70 m., the stream-velocity is 7.5–9 km. per hour. In contrast to this, in the lake-region it is merely 1.8–3.7 km. per hour. The rapids naturally have a much greater velocity. Also it is obvious that, below the rapids, rather large differences may appear in the water-level, and that the regulating influence of the Meervlakte on the water-level in the lower course is not so great as was once supposed.[6] On my arrival at Pionier-bivak, the lowest water-mark registered was 29 dm. below that observed at the arrival of the advance party. On April 8–10, and after that on May 20, 1920, the gauging apparatus showed the greatest height observed, namely + 42. Therefore, according to our observations, the difference in water-level amounted to 7.1 m.

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At sunrise the coast lay as an indefinite narrow strip on the horizon. Already we were in water of a dirty gray-green color, which presently changed to brown. Gradually, as we approached the coast, the water became more discolored, the counter-current stronger. Toward ten o'clock we approached the mouth of the river, which slowly emerged from the low level strip of land. Toward the east the coast ended in the nearby Cape d'Urville, toward the west it stretched out endlessly: a broad beach beaten by heavy waves and bounded by a long row of *tjemaras* (*Casuarina equisetifolia* Forst.), many of which had already been felled by the force of the waves. The estuary is 500 or 600 m. broad and drains its water into the sea without noticeably broadening. Possibly this coast [7] is rising with respect to the sea-level.

With our entrance into the estuary, we are suddenly engulfed by the country, and henceforth begins the endless succession of meanders which follow one after another. There is no distant view over the land. The morning mist still hangs upon the coast-line, one of the many daily recurrent phenomena, which frequently characterize the lowland in the tropics. The great Kampong Teba, located close to the shore on the right bank, is now abandoned.

In so far as is perceptible from the ship, the outer aspect of the shore-vegetation confirms the supposition that the tide never or very seldom forces itself into the mouth of the river. The extended mangrove-forests, which on the south coast intrude many kilometers into the country, are entirely lacking here. I see on the shores here and there small light green trees which might possibly be considered as mangrove plants, but immediately thereafter the old lowland-forest appears. Moreover, one notices at once the sago-palm (not *Nipa*),

[5] Moszkowski (l. c. 277) claims that during the east monsoon the north wind forces the brackish water up to 24 km. from the mouth of the Aiberam. He should have found here a strip of mangrove-forest 18 to 20 km. long. The influence of ebb and flow should be noticeable to van Pee Island. The distance from Pionier-bivak to the sea, according to van Gelder (l. c. 92), is about 240 km., from Pionier-bivak to Batavia-bivak about 65 km. By his aneroid readings, Koetei-bivak (Fragment I) is located at 26 m. altitude, Batavia-bivak at 51 m. Concerning the regulating influence of the Meervlakte on the water-level of the river, see van Gelder, l. c. 90.

[6] Verslag. Milit. Explor. Ned. Nieuw-Guinee 1907–1915 (Weltevreden 1920), 122.

[7] Concerning the probability of a rising north coast, see van Gelder, l. c. 93–94.

a typical fresh water plant, growing here. With field-glasses one can observe the spininess of the petioles and the leaf-sheaths. Close to the coast this region is clearly still marshy; the forest is relatively low. Very soon the shores and the forests alike become higher. At odd intervals on the bank a *Pandanus* stands, elsewhere a small bamboo-clump, here and there also a small strip of *gelagah* (*Saccharum spontaneum* L.). As for the rest, it is the usual aspect of a tropical forest-margin, with many lianas and clinging Araceae, a robust trunk being visible only now and again through openings. Sometimes a small hut of sago leaves lies hidden on the bank, one of the hunters' huts which the roving Papuans build as shelter for a night or two. For hours at a time we travel through this sparsely inhabited territory of almost perfect virginity, without seeing a trace of settlement. Hour after hour the same scenery: the broad river with ever new curves, the brown water with its eddies and driftwood, and the high forest-walls whence the sultry fragrance of the tropical primeval forest comes to us. And moreover, there are elements which characterize this country so strongly for the traveler that they become perfectly inherent in the New Guinean scenery for him: the flocks of screaming white parrots with their characteristic profile which fly over repeatedly, and the hornbills, the *ankangs*, the great plump black bird with its much too large beak and the creaking sound of its wings. These two permeate the landscape as if they were the spirit of it, but some other birds as well appear at first acquaintance to complete the picture: the stately soaring light reddish brown heron, which again and again flies across in front of the ship to settle a little farther away on a branch of a tree; sometimes also the flocks of *kalongs* (fruit-bats), which, especially at the sound of the steam-whistle, swarm out of a solitary tree standing in a *gelagah* [*Saccharum*] field, and circle around in great numbers, with their membrane-like wings shining in the sunlight, until silence has returned.

Gradually the river becomes broader, the mouth being narrower than many places higher up. *Gelagah* [*Saccharum*] fields appear in greater numbers and greater dimensions on the inside curves. We find so few points of comparison for judging the dimensions in this strange land that we at first thought the *gelagah* plants were four or five meters high. Later I measured a flowering specimen that was 9 m. high. The background of the high forest-walls measures 40 to 50 m., but, compared with the width of the river, its height is difficult to estimate, for it seemed much lower. Everywhere we see evidence of the continual changes in the course of the river. These take the form of steep eroded shore-banks, in lower spots frequently with areas of dead or dying trees, often also with piles of dead tree-trunks. Sometimes glimpses of low hills are to be seen, but the banks are still entirely flat. About 4 o'clock in the afternoon we pass Kerkhoven Island, after having been almost stranded at one o'clock by a new break in the river at van Pee Island. Almost immediately beyond Kerkhoven Island we see the first trace of hilly land in the form of a 5 m. high clay wall on the river-bank. Nearby is a kampong, but here also no trace of the population is seen. Toward dark we anchor in 9 fathoms 4 feet (17.4 m.) of water.

The following morning at sunrise, when we again get up steam, the light morning mist is still hanging over the tree tops. Three-quarters of an hour after our departure we pass the first hills on the bank. The forest is unmistakably thicker than farther downstream. Here and there specimens of the breadfruit-tree (*Artocarpus* sp.) are recognizable; once in a while we see a tree-fern, and

often the monotonous green forest-margin is colored by the orange-red inflorescences of a *Mucuna*. At last, not far from Pionier-bivak, we meet natives for the first time: a small proa with three men, two dogs, and a small fire, a combination which gives us a glimpse of the primitive life of these people of the primeval forest. We pass the mouth of van Gelder River, the only tributary of any importance in this region, where Franssen Herderschee camped in 1910. A little later we sail along the right bank, passing Duiven Island. Already in the distance the location of Pionier-bivak is visible. At quarter of ten we anchor in front of the inside curve opposite the bivouac, which, in the midst of a cleared place, looks small compared with the majestic surroundings of the mighty primeval forest against a background of blue hills.

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The knowledge of the flora of this region was based in 1920 on the following collections:

a. A collection of about 500 numbers of herbarium and preserved material and 115 living plants, of W. K. H. Feuilletau de Bruyn, at that time First Lieutenant of the Infantry.
b. Two hundred and seventy numbers brought together by the Medical Officer, A. C. Thomsen; this collection, like the previous one, was assembled on the banks of the Mamberamo and the Idenburg Rivers.
c. A collection of 625 numbers of herbarium and preserved material and 200 living plants gathered on the north coast of the mouth of the Mamberamo by Medical Officer R. F. Janowsky.

At the very time when this Fragment was being written, the writer's collection at Pionier-bivak and its vicinity, 388 numbers of herbarium and preserved material, was added, as well as that of Dr. W. M. Docters van Leeuwen, who in 1926 collected about 1000 numbers of herbarium and preserved material in this region.

I should here emphasize that the following sketch of the vegetation rests exclusively on my own collection and therefore is very incomplete. In particular, as far as tree-species are concerned, very little can be said on the basis of the collection. In reality, it is only a number of more or less coherent observations on the flora of this territory, which will perhaps serve as a groundwork upon which later writers may build further and to which they may add their own observations. However, before I give my own impressions, I shall give a brief ecological sketch of the vegetation. Similarly, I intend to do the same for each of the regions which will be discussed in these Fragments. At the same time this sketch will serve as a pattern to which we shall repeatedly return when describing other regions, and which therefore will serve as a basis of comparison. We take *Figure 1* as a starting point, a schematic representation wherein I have tried to bring together [8] the principal morphological and ecological characteristics of this plant-association, the tropical lowland primeval forest.

[8] Cf. also the strikingly precise description of a tropical rain-forest in: K. Sapper, Geologischer Bau und Landschaftsbild, 2. Auflage, Bd. 61 van "Die Wissenschaft" (Vieweg, Braunschweig 1922), p. 107 and following, and in: Id., Die Tropen–Natur und Mensch zwischen den Wendekreisen (Stuttgart 1923), p. 60 et seq.; these articles I can warmly recommend for reading.

In its ideal form the tropical primeval forest is an organism, the lower limit of which is the ground, the upper the forest-roof. The latter is supported by what may be designated as the forest-skeleton: the trunks of giant trees, frequently without branches, which rise several score meters, their crowns forming the forest-roof. But there is still a third limit—the margins, such as we find along the river-banks. Both the roof and the margins are closed to such an extent that entirely different conditions prevail within the forest than outside, where the sun, the wind, and the rain have free play. Within the forest the light is dim, frequently suggesting twilight, the wind as well as the light is broken, and the rain loses its force. This is why all outward conditions within the forest remain within very strict limits. And whereas outside all sorts of extremes of light and dark, of wind and calm, of extreme heat and sudden cooling, of great humidity and dryness, are possible, yet within the forest these conditions are extremely constant, as if the inner parts of the forest were a

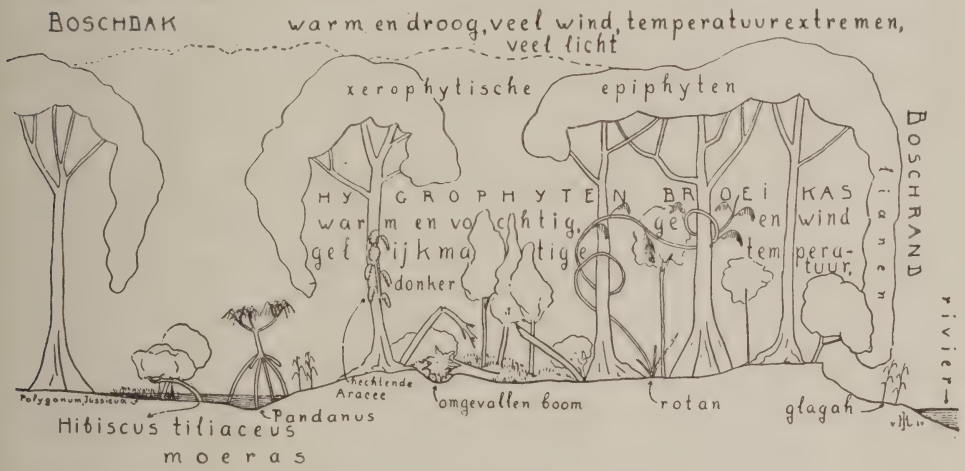

FIG. 1. Schematic representation of the rain-forest. Boschdak = forest-roof; boschrand = forest-margin; broeikas = conservatory or hot-house; vochtig = damp; g[e]lagah = *Saccharum;* gelijkmatige = even; moeras = marsh.

natural conservatory wherein the light alone changes with day and night. For not only is the forest-roof thick, but also, even in still stronger measure, the forest-margin is closed by the overwhelming mass of lianas which frequently extend to the ground, and which can form so thick an undergrowth that—unfairly, as we shall see—the forest itself has been called impenetrable. In very broad outline these are the ecological principles of the tropical rain-forest, a plant association of which we, with Schimper, accept as a fact that it originated through an equable rather high temperature and a rainfall of at least two meters evenly distributed over the year.

In such a rain-forest, with its conditions optimum in many respects, the struggle for existence among individuals and species is so sharp that, with an equal degree of justification, one can defend the proposition that these species and individuals, which carry on a life and death struggle, are units, while the primeval forest in its entirety may be looked upon as a mighty organism, wherein, as in all organisms, the maintenance of equilibrium is constantly sought. For if the balance becomes disturbed somewhere, for example by the

crash of an old forest giant, which in its fall has torn open a gap in the forest, has broken the forest-roof, and therefore has greatly changed the conditions in that spot, then we see immediately how the flora reacts at the infliction of the wound. Thus in the human organism the thrombocytes and the leucocytes: there develops at the site (of infection) an accelerated growth, a crowding of life's forces, and an increased energy, with the result that the wound becomes temporarily closed and the skin is very quickly healed again. In the injured forest there immediately arises in such a place a dense mass of tall herbs, shrubs, and young trees which now for the first time have an opportunity to develop. At the same time the loose flexible branches of lianas descend from the forest-roof slowly to join with the lower flora and thus close anew the forest-roof. So it is, seen from the standpoint of the primeval forest as a unit; but from that of the individual or species it is a reaction to suddenly changed conditions. The obligate hygrophytes disappear, now that the full sunlight, the rain, and a little wind can reach the ground. But all sorts of other plants, which mostly otherwise would not even commence to develop, now shoot up and begin striving with each other for light. Again in this struggle a few slowly triumph, in the long run not more than one or two trees, and thereby the wound is healed. Meanwhile fungi and bacteria have done their work, completely destroying the fallen trunk.

The conservatory under the forest-roof is the dwelling-place of hygrophytes, plants which can live only in an atmosphere of continuously very high humidity. Here the humidity almost always ranges between 90 and 100%; [9] in such a tropical rain-forest there are plants with leaves not more than a single cell-layer in thickness (Hymenophyllaceae). Others possess arrangements by which they may shed water as quickly as possible; for instance, the drip-tips of the leaves of some species do that mechanically, aided by the sloping position of the leaf. Many leaves possess water-glands or hydathodes by which water is secreted during those hours when the maximum relative grade of humidity is such that evaporation cannot take place. In this way, under the conditions outlined, these plants maintain the necessary water-stream from the roots to the leaves. In general, the dimensions, the thinness of the leaves, and the possession of a great number of stomata work to the same end.

On the soil rich with humus, in this hot-house of the thick forest, usually little grows, a result of the lack of light which seems to be a limiting factor. Autotrophic plants which grow here frequently have a poor appearance; on the other hand, plants which require no light, such as fungi, bacteria, and higher saprophytes, ordinarily are common and thrive luxuriantly. In lighter places, however, distinct herbs often appear, frequently in small communities, as for example a few Araceae, ferns, and species of *Elatostema* and *Selaginella*. Shrubs are thin and scattered and frequently possess not a single complete leaf, all being much injured by insects and in addition covered with epiphyllous mosses and algae. Their flowers are usually inconspicuous in size and color, often greenish or white. Above these shrubs rise smaller trees, likewise thin and slender, frequently with bolt upright trunks, while leafless stems of large lianas twine themselves into all sorts of contortions through the forest. Then follow some stories of ever larger trees which, however, all remain under the forest-roof, their crowns forming a natural forest-cover according to some

[9] Cf. Fragment II, table I, observations on cleared land; in the forest the relative condition of humidity is considerably higher.

authors, but I have seldom seen this cover to such an extent. Some research workers, such as Wallace,[10] Beccari,[11] and Brown,[12] think they are able to distinguish fairly sharply separated stories. Between these trees, whose trunks are hidden under many clinging plants (especially Araceae and ferns) and hygrophytic epiphytes (ferns and mosses), there are the particularly bad groups of *Pandanus* species and rattans which, with the fallen giants of the woods, make the forest locally almost impassable. Moreover, I naturally conclude that the character of the soil itself does not influence this.

Therefore, only the highest trees, with their vast crowns forming the forest-roof, are exposed to conditions other than those of the previously discussed group. Their crowns are exposed to the full influence of sun, wind, rain, and changing temperatures, and consequently they cannot be considered particularly as hygrophytes; nevertheless, the conditions are not so extreme that they may be called xerophytes. Here also the external factors of the equatorial climate are still confined within very narrow limits. Furthermore, the roots of the very same trees live in the more favorable circumstances of the hygrophytic forest. So, one considers the woody giants in such a forest and also in part the secondary trees as belonging to an ecological group between the extremes of hygrophytes and xerophytes, namely, the mesophytes.

But true xerophytes naturally are the epiphytes which live above in the forest-roof. Exposed to the same outward circumstances as the crowns of the forest-giants, they lack entirely the conditions of the last to take up water conveniently, and they must manage to get along with the small amount of water which they can absorb as vapor out of the atmosphere and the little which they can obtain during periods of rainfall. It is obvious then that such plants usually are small and possess more or less well-developed water-tissue which allows them to use this water, once taken up, as economically as possible. In brief I wish to remind my readers that, until recently, the earlier opinion of Schimper [13] was held, that xerophytism (the word xerophily is wrong, since these plants are not drought-loving but drought-enduring) is expressed only in morphological-anatomical characters. If one saw a plant with hard thick leaves, with a thick hairy covering, with a waxy or thick cuticle, then that plant would be without doubt a xerophyte. The latest researches, for example those of Maximov [14] on plants of the steppe, and of Senn [15] on alpine vegetation, have proved that a xerophyte is characterized, in the first place, not by a morphological-anatomical adaptation, but by a physiological one. Earlier, it was thought, on the basis of outward observations, that xerophytes possessed means of preventing evaporation. Exactly the contrary is true; evaporation in xerophytes is very much greater than in mesophytes, and the outer or epidermal covering is not important except when the stomata are closed (and that happens in sudden drying). The adaptation of the xerophytes lies therefore, in a greater resistance against and an easier endurance of prolonged drying up.

[10] A. R. Wallace, Natural Selection and Tropical Nature (1895), p. 240, cited by Brown, l. c. 33.

[11] O. Beccari, Nelle Foreste di Borneo, 2nd edition (1921), p. 412.

[12] W. H. Brown, Vegetation of Philippine Mountains (Manila 1919), p. 31.

[13] A. F. W. Schimper, Die epiphytische Vegetation Amerikas, Bot. Mitt. aus den Tropen II (1888); see also W. H. Brown, Veget. Philipp. Mountains, p. 296.

[14] N. A. Maximov, Physiologisch-ökologische Untersuchungen über die Dürreresistenz der Xerophyten, Jhrb. f. Wiss. Bot. LXII (1923), I, 128.

[15] G. Senn, Untersuchungen über die Physiologie der Alpenpflanzen, Verh. d. Schweiz. Nat. f. Ges. 1922, II, 154.

For this, in addition to the previously mentioned morphological-anatomical characteristics, the following are also compensating factors: a high osmotic pressure in the root-cells of terrestrial plants, a strong evaporation (hence, in general, a powerful water-transportation), and the possession of much mechanical tissue. Some morphological observations are not primary but merely a consequence of the physiological quality, as, for example, the smallness of the plants, which is a result of the delayed carbonic acid assimilation by the repeated closing of the stomata. As means of diminishing the evaporation surface, the smallness of the leaves can well be a morphological adaptation, just as is the possession of water-tissue or water-reservoirs in tubers, stems, or leaves. Extreme xerophytism appears frequently to coincide with the presence of such a water-tissue; one recalls, for instance, Cactaceae, *Mesembryanthemum*, *Sedum*, *Sempervivum*, *Agave*, and many others. A large number of epiphytes (Orchidaceae, *Hydnophytum*, and *Myrmecodia*) have similar organs, thick leaves, tubers, etc. Moreover, some epiphytes can catch or absorb the little available water quickly, the orchids, for example, taking up capillary water through the long gray aerial roots.

Finally there is the forest-margin, where nearly the same conditions prevail as on the forest-roof, only in less extreme measure. In this habitat lianas and rattans especially are quite numerous, but most of these develop fully particularly in the forest-margin, which they often entirely cover with their long pendent and thickly foliaged branches. They also are mesophytes and they too can absorb water from the ground *ad libitum*. That they continue to do so in large measure is noticeable by the structure of their stems, the wood of which is perforated with very large vessels which often, and especially after rainy weather and in the full sun, contain so much water that they are a welcome source of drinking water—welcome also for the trustworthiness of this source. In these forest-margins the most colorful flowers are to be seen. Many lianas have large flowers with striking colors. Within the forest they rarely occur. I need not here refute the fairy tale of the "luxuriant tropical forest with its beautifully colored flowers and butterflies;" it probably originated in the minds of those who know tropical forests not through their own observations but through fancy, since enthusiastic and superficial observers are charmed by the colored pictures in the encyclopedias and by imagination. Furthermore, one observes practically nothing of animal life except insects, and of these frequently too many. Larger animals are rarely observed, but their tracks are often seen. Many of these forest-dwellers are nocturnal; moreover they are shy and flee quickly and quietly at strange noises. Frequently then during the day there prevails in the sultry calm of the forest an almost perfect silence which, moreover, is accentuated by the melancholy deep cooing of large doves and is broken only by the screams of parrots or the rough bickering of hornbills, and sometimes far in the distance by the hoarse cry of a cassowary. The cicada chorus naturally is heard at night, but chiefly in open places, as in the vicinity of camps. In the forest itself this chorus is hardly sufficient to disturb the impression of a deep smouldering stillness.

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The region about Pionier-bivak (*Fig. 2*), which, according to estimates, has an altitude of 60–70 m., is controlled especially by the river, inasmuch as the hills do not approach the bank. The flat parts consist of a heavy clay rich

with humus and are intersected by a number of creeks with nearly impassable beds of soft deep mud. In *Figure 2* one of the creeks is designated as *a*, viewed towards the southeast. Here and there are small marshes (*b*, *c*) between the elevations of land, and not far from the river sharp little ridges begin as foothills of the mountains farther inland. I shall presently consider the names of a few plants and plant-associations which we find here. It does not seem unsuitable to me to begin with Pionier-bivak itself, because here we find a number of weeds well worth brief consideration. In connection with this idea I should like to arrange under this concept the species belonging to the native flora which persist as well as the adventive ones which have come from outside, plants which more or less tolerate or even prefer the presence of men who clear openings in the forest. So far this place is more remarkable for weeds than most others

FIG. 2. Small sketch-map of the vicinity of Pionier-bivak; explanation of the letters in the text; the contours are at 5 m. intervals.

because the camp is surrounded on all sides by hundreds of kilometers of primary forest, where the adventive plants do not occur. We have therefore an area before us from which, for the larger part, the original flora has disappeared. Hence the conditions which prevail in the forest have become drastically changed. In the first place nearly all hygrophytes find it impossible to live here. Most mesophytes have been and still are being violently removed. Thus conditions are created which make it possible for other plants ("*anthropochoren*" or "*anthropophilen*"—plants of dwelling places or plants following man) to penetrate (if only they were present) and to live beside the native plants which can persist under these conditions (*apophytes*). I found in the open region of Pionier-bivak a number of truly adventive plants, which, therefore, either indirectly or directly must have been introduced by man. Pionier-

bivak was established at this location in December 1913, but about a year later it was abandoned. The growth became so dense that the advance-guard of our expedition encountered here in February 1920 a luxuriant stand of shrubs and young trees. I must, however, point out that in the neighborhood there were present some small foci of infection, that is to say, the old Pionier-bivak (May 1911) on the left bank of the Okten River (*Fig. 2, d*) near our Pionier-bivak, and furthermore, at a greater distance away was Koetei-bivak (January 1910) on the van Gelder River; possibly also the settlements of the Papuans have exercised some influence on this. For the sake of completeness I recall the ascents of 1880, 1900, 1906, and 1909, but for the importation of adventive plants those can scarcely have been of any importance.

The list of weeds (ruderal plants) [16] which I found follows:

I. Throughout the tropics or of wider distribution:

1. *Ageratum conyzoides* L., originally native in South America, now pantropic.
2. *Eleusine indica* Gaertn., also in the subtropics.
3. *Euphorbia hirta* L. (*E. pilulifera* L.)
4. *Euphorbia thymifolia* L.
5. *Lindernia crustacea* F. v. Muell., originally native in the Old World, now pantropic.
6. *Mitreola petiolata* Torr. & Gray (*M. paniculata* Wall.).
7. *Oldenlandia corymbosa* L.
8. *Paspalum conjugatum* Berg., originally native in South America, now pantropic.
9. *Portulaca oleracea* L., in all warmer regions.

II. Tropics of the Old World:

10. *Amaranthus caudatus* L. (*A. gracilis* Desf.).
11. *Lindernia pyxidaria* All., also in the subtropics.
12. *Oldenlandia diffusa* Roxb.

III. Southeastern Asia:

13. *Lindernia mollis* Wettst. (*Vandellia mollis* Benth.), Himalaya, China, Malaya, Sumatra.
14. *Ilysanthes antipoda* Merr. (*Bonnaya veronicifolia* Spreng.), British India, China, Malayan Archipelago.
15. *Stachytarpheta indica* Vahl, British India, Malayan Archipelago [Native of tropical America].
16. *Pouzolzia zeylanica* Benn. (*P. indica* Gaud.), tropics and subtropics of British India, South China, Malayan Archipelago, and Australia.

Moreover, here grew apparently as ruderal plants a couple of Cucurbitaceae (nos. 629, 630). [These are *Momordica cochinchinensis* Spreng. (trop. As.-Arch.) according to the Addenda.]

The most striking fact in the above list is that almost all of these plants have a very wide distribution. Not less than 9 of the 16 or 56% are tropical cosmopolitans, and 12 or 75% are widespread over the tropics of the Old World (Australia sometimes excluded). Probably their slight fastidiousness in respect to outward conditions and their easy mode of dispersal predetermine these plants to cosmopolitanism. Regarding the manner of distribution of the plants mentioned above, not less than 13 of the 16 possess very small, more or less round, smooth or wrinkled seeds or fruits which, where great distances are concerned, are spread chiefly through the influence of people; of the remaining three, the method of dissemination is more uncertain. *Ageratum conyzoides* L., with fruits crowned by five tolerably stiff acute calyx-lobes, is perhaps spread

[16] The determinations I owe to Mr. C. A. Backer, formerly of Buitenzorg, now of Pasoeroean. Here, as in later instances, I have used Merrill's Enumeration of Philippine Flowering Plants, I–IV (1922–1926), for the nomenclature and distribution.

by birds; both grasses, *Paspalum conjugatum* Berg. and *Eleusine indica* Gaertn., are perhaps spread by the wind, possibly by people.

As for the apophytes which have persisted at the bivouac, we can perhaps include some Cyperaceae, such as *Fimbristylis* (no. 635) and *Cyperus*, and also a species of *Jussiaea* (no. 506), all of which occurred in a small marsh (*Fig. 2, b*).

We now come to the discussion of a real forest-flora. We have already seen above that, as a rule, it is not the forest which makes this land so particularly hard to penetrate in many places. It is true that here and there appear somewhat hindering rattan or *Pandanus* complexes, but, generally speaking, the forest itself is not especially thick apart from the forest-margin. Here chiefly it is the nature of the soil which makes the terrain so arduous. Whoever does not know a country such as New Guinea cannot easily imagine those difficulties, which likewise cannot be made clear by means of pictures. One must himself have roamed around over this soft, miry, and slippery terrain with its unexpected deep muddy creeks, frequently very difficult to pass, with their steep banks. This condition prevails in the "dry" season. In the rainy season, when the river fills and more than fills with its water all the muddy creeks far back into the land—also in the neighborhood of Pionier-bivak—then this region offers difficulties which even for experienced woodsmen have remained unsurmountable. It happened once, during our expedition, that provisions had to be brought to Edi-bivak, where the advance-guard was imprisoned by a sudden rise of water and the supply of food was exhausted. One of the non-commissioned officers, an experienced jungle runner, was given an order to open a path with a group of convicts in the direction of that camp which was 22 km. distant in a straight line. The group worked five long days with might and main, contending with the numerous muddy creeks which sometimes had to be circumvented by detours 700 to 800 m. inland. After the fifth day it had not advanced farther than Havik Island, 2 km. distant from Pionier-bivak.

As mentioned above, owing to a number of circumstances, I collected little tree material in this territory. Therefore, from the hundreds of tree species, there is little to be gained by naming the few which I caused to be felled and from which I secured material. Later explorers, and first among them Docters van Leeuwen, who examined this terrain more intensively, doubtless will be able to contribute thereto more valuable data. It is sufficient to mention *Intsia amboinensis* Thouars (no. 612) (Arch.),[17] a tree regularly sought for by the Dyaks from which to make their proas. A woody giant I came across in the middle of the forest was *Pittosporum ramiflorum* Zoll. (E. Arch.), which, although 45 m. tall, did not protrude above the forest-roof. Also I have seen enormous *Ficus* species on the other side of the river somewhat inland from the site where in 1926 the Albatros-bivak was built. I once saw a giant specimen some 60 m. in height, with a large number of aerial roots, which together surely covered an area 20 m. in diameter. It is hardly necessary to mention that *Ficus* species are also abundant in this forest (nos. 653, 729, 731, 757, 758, and 765). Likewise *Jambosa Thomseni* Diels,* with pretty purple-red flowers, was a rather tall tree (35 m.).

[17] The distribution will be given shortly and comprehensively by: Arch. (entire Malayan Archipelago), W. Arch. (western part of it), E. Arch. (eastern part of it). Phil. (Philippines), Trop. As., Trop. S. E. As., N. Austr., Polyn. (Polynesia), Trop. O. W. (tropics of Old World), pantrop. (tropics of whole world), and others. New species are indicated by an asterisk. The addition "end." (endemic) stands in some places also for endemism in its wider sense, thus, for example, including the Bismarck Archipelago.

On the north side of the camp is one of the many small marshes which lie along the river (*Figs. 1* and *2, c*). Here the forest roof is more or less interrupted and the sunlight falls on the crowns of the low Pandanaceae which form the higher overgrowth. On the drier margins typical small trees such as *Kleinhovia hospita* L. (no. 743, trop. As.) and *Vitex Hollrungii* Warb. (Arch.) occur, while *Hibiscus tiliaceus* L. (pantrop.) var. *abutiloides* Hochr. and *Cordyline terminalis* Kunth (trop. As.-Polyn.) frequently are close to the margin of or even partly in the water. Towering over all plants in many spots breadfruit trees (*Artocarpus ?communis* Forst.; Arch., Polyn.) raise their crowns. The shallower parts of such little swamps frequently have a compact growth of Cyperaceae (nos. 533 and 535), *Jussiaea* (no. 506), and *Polygonum dichotomum* Bl. (trop. S.E.As.-N. Austr.). *Combretum tetralophum* Clarke (trop. As.-N. Guin.) creeps along on marshy ground.

In the forest the smaller trees are naturally more easily reached. Among them are some which are conspicuous because of their colorful flowers, such as *Ixora Kerstingii* K. Schum. & Lauterb. (end.; nos. 557, 768) and *Phaleria* (no. 461), the last cauliflorous. A species of *Tabernaemontana* is especially obvious because of the very light large orange-colored fruits, which one sees floating everywhere on the river and which one may observe even at sea. Other smaller trees, 10–15 m. high, belong to the Rubiaceae, such as *Timonius stipulosus* Boerl. (Celebes, N. Guin.; no. 478) and *Tarenna Guelcheriana* Val. (E. Arch.), and to the genera *Sterculia* (no. 471), *Dillenia* (e. g. *D. pedunculata* K. Schum., end., and *D. castaneifolia* Miq., end.), *Pycnarrhena* (*P. grandis* Lauterb., end.), and *Semecarpus* (*S. Lamii* Slis* and *S. fulvo-villosus* Lauterb., end.), the last genus with the black resin, characteristic for so many of the Anacardiaceae, which causes an itching inflammation of the skin. Also species of *Laportea*, tropical stinging nettles, are not uncommon, as *L. decumana* Wedd. (Arch.). In addition some small palms are widespread in all stories of the primary forest (nos. 651, 672, 728). I name further *Stemonurus ramuensis* Lauterb., the myrmecophilous monimiaceous *Anthobembix dentata* Val. (no. 769, end.), a *Horsfieldia* (no. 770), *Conocephalus Gjellerupii* Hub. Winkl. (end.), *Santiria acuminata* K. Schum. (end.), and a few noteworthy Leguminosae, namely *Maniltoa gemmipara* Scheff. (no. 670, end.), which is cauliflorous (as is *Phaleria*), and *Hansemannia* (no. 692, end.) with regular flowers in which the thick clusters of white stamens make one think of a species of the Myrtaceae or the Lecythidaceae. Also I found here *Desmodium umbellatum* DC. (trop. As.).

Along the banks of the Okten River are *Kleinhovia hospita* L., *Premna integrifolia* L., and a number of species of *Ficus* which all are abundant. Here and there one finds *Erythrospermum Wichmanni* Val. (end.), the white-flowered *Lepidopetalum hebecladum* Radlk. (N. Guin., Key and Aru Is.), and the beautiful *Schuurmansia* (no. 481), a small and slender tree, frequently bent over the water, its long narrow leaves very thickly crowded at the apices of the branches, while from the middle of this foliar cluster protrudes the very large clear purple inflorescence with a profusion of small flowers.

Amongst the shrubs there are almost none that have showy flowers and fruits. I found there representatives of the following genera: *Ardisia* (no. 432), *Saurauia* (*S. mamberamana* Diels * with white or rose flowers), *Solanum* (nos. 636, 706), *Diospyros* (no. 698), *Antidesma* (nos. 660, 707), *Breynia* (no. 746), *Garcinia* (no. 750), *Cyrtandra* (nos. 441, 759), *Gomphandra* (nos. 427, 657),

Amaracarpus (*A. mesophyllus* Val.*), *Pipturus* (*P. argenteus* Wedd.; Arch., Polyn.), *Semecarpus* (*S. magnificus* K. Schum., end.), *Chisocheton* (nos. 502, 573), *Orophea* (*O. Dielsiana* Diels, end., nos. 433, 492), *Pittosporum* (*P. galai* K. Schum., end., no. 723), *Melodorum* (*M. micranthum* Warb., end., no. 751), *Tylecarpus* (*T. papuanus* Engl.), and *Aphania cuspidata* Radlk. (N. Guin., Waigeoe; nos. 416, 418). All the plants mentioned have inconspicuous small flowers, often greenish white in color. Yet there are shrubs which are more showy. For instance, I found here an *Abroma* (*A. fastuosa* R. Br., trop. As., Austr.; no. 465) with flowers which attract attention by their elegant and unusual structure and the combination of darker modest colors, purple-brown and yellow. A couple of *Clerodendron* species also give color to the undergrowth. Most species of the latter genus occur in somewhat more open situations and frequently are decorative with their colorful inflorescences. Those met with here have their flowers whitish mingled with rose and lilac; they are *C. buruanum* Miq. (E. Arch., Phil.) and *C. porphyrocalyx* Schum. & Lauterb. (end.); the latter is beautiful after blossoming on account of its enlarged fiery red calyx, against which the black fruit shows in sharp contrast. Some color is given to the forest by a few Rubiaceae, not on account of their corollas, but because of the enlarged calyx-lobes. Not only *Morinda umbellata* L. (S. E. As.) var. *papuana* Val. and *M. bracteata* Roxb. (Arch.) var. *celebica* Miq., but also *Mussaenda cylindrocarpa* Burck (end.), show this phenomenon; besides, in the first-named species the tuber-like inflorescence and infructescence attract attention. Just as on many other islands in the Archipelago, the family here also is richly developed in the undergrowth. In addition to its representatives already indicated, I found a *Pavetta* (no. 498) and a few species of *Psychotria* in damp places, *P. obscura* Val. (end.), *P. subherbacea* Val. (end.), *P. leptothyrsa* Miq. (E. Java, Moluccas, N. Guin., Palau; nos. 494, 699), and no. 678. Also represented here are *Oldenlandia corymbosa* L. (N. Guin., Carol.), *O. diffusa* Roxb., *O. pubescens* Val. (end.), and the half-shrubs *Ophiorrhiza seriata* Val.* and *O. cuneata* Val.*

As we have already seen, there are not many herbs on the forest-floor. In a few places there are small areas of *Selaginella* (*S. gracilis* Moore, end.) typical of the primary forest, and of *Elatostema*, here represented by *E. Weinlandii* K. Schum. (end.), *E. Pellionianum* Gaudich. (E. Arch.), and *E. novoguineense* Warb. var. *angustifolium*, over which the first predominates. Scattered in not too dry places are some Begonias (nos. 459, 467, 563, 752, 760), in more moist spots Cyperaceae, such as *Scleria* (no. 479) and *Cyperus* (nos. 632, 715). In darker parts of the forest robust Zingiberaceae (nos. 480, 484, 499, 501, 572, 638, 650, 656) are common; we also find here species of the genus *Phrynium* (nos. 444, 449, 562, 648), some Commelinaceae (nos. 496, 716, 724), among them the beautiful *Forrestia mollissima* Koord. (Arch.; nos. 450, 659) with its bright purple flowers and fruits and orange seeds; *Donax canniformis* Rolfe (Arch., Polyn.) is fairly plentiful, and in addition a few Acanthaceae, as *Peristrophe tinctoria* Nees (no. 421, trop. As.), *Lepidagathis hyalina* Nees (no. 528, trop. As.), *Hemigraphis reptans* T. Anders. (no. 403, E. Arch.), and a species of *Hygrophila* (no. 412). The rest of the low flora consists almost entirely of ferns and Araceae, scattered and in small communities. In the Araceae I found here *Schismatoglottis pomatophila* v.A.v.R.* and *S. angustifolia* v.A.v.R.*, both with white and greenish spadix and white spathe, also *Homalomena pygmaea* Engl., *H. lilacina* v.A.v.R.*, and *Holochlamys elliptica* v.A.v.R.* In

a marshy creek-bed near Pionier-bivak (*Fig. 2, c*) was a community consisting exclusively of *Helminthostachys zeylanica* Hook. f. (trop. As., Austr.), *Pleopeltis aquatica* v.A.v.R., and *Holochlamys guineensis* Engl. A very large part of the terrestrial ferns belong to the typical hygrophytes, the Hymenophyllaceae. Here, for instance, *Trichomanes infundibulare* v.A.v.R.* occurs in large numbers; other extreme hygrophytes are the delicate *Lindsaya tenuifolia* Bl. (Arch., Polyn.) and *Asplenium cuneatum* Lamk. (pantrop.). In the terrestrial group also are the small *Schizaea dichotoma* Sm. (trop. O. W.), *Campylogramma pteridiformis* v.A.v.R.*, *Pteris Warburgii* Chr. (E. Arch.), and *Dryopteris schizophylla* v.A.v.R.* Near the location of the later Albatros-bivak on a gravelly bank skirting the inner bend of the river and overgrown with a young but already tall forest, I observed a sparse development of *Asplenium pseudovulcanicum* v.A.v.R.*, *Dryopteris urophylla* Chr. (trop. S. E. As.—Polyn.), and *Dictyopteris irregularis* Pr. (Arch.), with *Dipteris dissecta* O. Ktze. behind the natural bank in damper places as practically the only ground cover.

Here and there also are some small terrestrial Orchidaceae,[18] such as the demure *Microstylis Lamii* J. J. Sm.*, which seems to prefer a habitat of stones overgrown with moss. In addition are *Goodyera confundens* J. J. Sm. and above all the beautiful *Zeuxine amboinensis* J. J. Sm. var. *argentea* J. J. Sm., with a rosette of fairy-like leaves prettily marked and reflecting a metallic lustre. On more open places, for example on shaded river-banks, a handsome *Spathoglottis* (*S. grandiflora* Schlecht., no. 564), about 1.5 m. high and with lilac flowers, is also frequent.

Both the terrestrial Orchidaceae and the higher saprophytes are widespread. For instance, *Cotylanthera tenuis* Bl. (Arch.), one of the Gentianaceae, with pale stems, scale-like leaves, and a small pale lilac, yellow, and white flower, is common here. Locally such saprophytes may very well be common, a number sometimes being found together. This is especially the case with the fine species of *Sciaphila*, which are rather inconspicuous, first because they frequently are hidden almost entirely under fallen leaves, and second, because they do not stand out against the forest background on account of their dark red color and slender habit. I found here *S. longipes* Schlecht. (end.) and *S. andajensis* Becc. (end.) growing together, the first being taller, about 25 cm. as opposed to the second, which is 10 cm. high. The same color, perhaps more purple, is seen also in the vegetative parts of *Epirrhizanthes papuana* J. J. Sm. (end.), the inflorescence of which is dirty white.

The fungi, richly represented here, are by far the most important saprophytes. They and the bacteria form a large group which, with the assistance of high temperature and great humidity, effect disintegration in nature, thus playing an important part in the cycle of matter. A number of the fungi decompose dead wood; others prefer decayed organic material in the form of humus. The beautiful shining black (like sealing wax) fungi[19] of the genus *Ganoderma* (*G. Cochlear* Murr.) belong to the first group. Amongst others growing on wood I came across *Lentinus maculatus* Berk., *Polyporus arcularius* Fr., *Trametes Persoonii* Fr., and two species of salmon-colored *Pilocratera*, an ascomycete in the form of a short-stalked little cup (*P. Hindsii* Henn. and *P. tricholoma* Henn.). *Polyporus rugosus* Nees is one of the most peculiar of the

[18] The determinations of the Orchidaceae by Dr. J. J. Smith are available only in manuscript, so that in most cases no mention of distribution or of new species can be made.

[19] I owe the determinations of the fungi to the late Dr. C. van Overeem.

polypores growing on humus. The lower side of the pileus is almost entirely black; the immature round thick cap, gray-white beneath, rises on a stalk 1–40 cm. high. This species is solid and hard, like many fungi living on dead wood. Most fungi growing on humus are fleshy and soft, as, for example, the profusely branched *Clavaria* species (no. 549). A pretty sight in the forest is the beautiful *Dictyophora* (probably *D. phalloidea* Desv., pantrop.; nos. 443, 2089) which I found at various times, always growing singly. I fortunately had an opportunity to follow its development, being located nearby. On the first day of observation, I found the "devil's egg" at 6 P. M. between the plank-buttresses of a woody giant. The top of the white-gray oval object, the upper half of which protruded from the ground, then showed a small tear through which a yellow jelly-like mass was visible. Just 24 hours later the split had opened only a little farther, but on the third day at 8 A. M. a small yet unveiled head protruded on a short stalk about 7 cm. above the ground. In this phase, development is very rapid: not an hour later the plant was full-grown, and it shone with a stalk about 15 cm. high and a small conical gray head thickly beset with tiny carrion-flies and little butterflies. From the constriction beneath it, the beautiful net-like pure white veil flared widely below. Toward midday the veil began to lose its turgor and at one o'clock it hung down withered. At six in the evening the head nodded low and the following morning the entire fruiting body lay already half-decayed on the earth.

The most remarkable discovery in this territory was *Echinophallus Lauterbachii* Henn., known from the Moluccas and New Guinea. The full-grown fruiting body of this fungus, allied to *Dictyophora*, appears still to be unknown. I found only the "egg" phase. The generic name is derived from the fact that the "egg" is not smooth but so thickly studded with numerous prickles that one might compare it with a colorless *rambutan* fruit (*Nephelium*). Later (middle of 1926) I found the plant, again immature, on Morotai, northeast of Halmahera.

Other fungi of this territory in my collection are under the following numbers: 411, 415, 426, 434, 488, 504, 512–524, 541, 546, 550–552, 559, 561, 569, 574, 576–579, 587, 588, 620, 665, 673, 713, and 774.

Now that we have seen what there is to be found in the forest-terrain, I shall devote a little further attention to the plants growing in the forest-framework and the forest-roof, the climbers, the clinging plants, and lastly the epiphytes. Among the clinging plants here, the ferns and the Araceae again take the leading place. Pressed against the tree-trunks, they work themselves upward toward the light that most of them never reach. In the Araceae one finds plants varying in size from the small species of *Pothos* to the giant *Rhaphidophora*. A large number of these seemingly form a transition between the climbing plant and the epiphyte; for, although they can live on without difficulty, when for some reason their connection is broken with the ground, they never appear to attain this situation of their own accord. In addition to the frequently numerous anchoring roots which grasp the host-trunk horizontally, these plants also possess other roots, which must surely be interpreted as absorbing roots. These grow down perpendicularly along the trunk, becoming continually thinner toward the lower part of the plant, so that in full-grown specimens only very thin rootlets reach the ground. It is clear that these rootlets are altogether insufficient to meet the daily water need of these large, leafy, and doubtless strongly transpiring plants. It has also been ob-

served that the plants, without experiencing loss, keep on living and growing when the rootlets are removed. Hence, just as in epiphytes, the necessary water-supply must be furnished in other ways, for instance with the help of clinging or aerial roots. Thus a mutilated plant has in reality become an epiphyte. We are inclined to look upon such cases as a transition between an epiphyte and a clinging plant, that is to say a form which perhaps is working its way up from a clinging plant to an epiphyte, in a certain sense therefore a semi-epiphyte. This term was introduced for another group of plants, which normally begin their life as epiphytes (many species of *Ficus*, for example) and later, by sending out aerial roots, obtain contact with the ground, a contact which thereafter they cannot afford to lose. Thus in a way, our form of semi-epiphyte is a more advanced stage. We should be able to distinguish them as *deutero-hemi-epiphytes* in contrast with the *protero-hemi-epiphytes*, among which, for example, we would understand the afore-mentioned *Ficus* species. Karsten asserted somewhere [20] that "die Araceenpflanze des weiteren auf epiphytisches Leben angewiesen (ist)," but here in the Indies I have never observed a case of spontaneous breaking of the connection with the ground.

Many of the Araceae may become very tall and drape the central parts and sometimes even the higher branches of the trees with their large frequently lobed dark green leaves. The genus *Rhaphidophora* is well-represented among them. I found here *R. obliquata* v.A.v.R.* (with fiery red fruits), *R. novo-guineensis* Engl. (end.), and *R. latifolia* v.A.v.R.*; *Pothos Albertisii* Engl. (end.) and *Epipremnopsis magnifica* v.A.v.R.* also have red fruits. *Pothos Versteegii* Engl. (end.) is common.

Amongst the ferns the number of different species is overwhelming. In the vicinity of Pionier-bivak a *Stenochlaena* sp. (*S. ?aculeata* Ktze., no. 424) is especially common. Young plants are frequently found on the small trunks of young trees; the pinnate fronds bear pinnae only in one plane, closely appressed to the slender trunks and almost covering them. At the apex of older specimens, fronds of entirely different form develop; they are much larger and are no longer appressed against the host-trunk, but hang free. Above these the fertile fronds develop.

In addition to species of rattan, here are a great many specimens of *Flagellaria indica* L. (trop. O. W.), an often robust liana, which climbs upward with the aid of tendriliferous leaf-tips. The white-flowered *Faradaya splendida* F. v. Muell. (E. Arch.) is common too, but almost exclusively along river-banks. A very sturdy species of *Piper* (no. 685), related to the Australian *P. Mestonii* Bailey, occurs generally both in the forest and on the river-banks. Owing to its fiery red stout infructescence, it presents a striking appearance in the forest. Other climbers include *Dioscorea oppositifolia* L. (no. 761; S. E. As.), *Medinilla Lorentziana* Mansf.* var. *suffruticosa* Mansf.* (no. 495), *M. quintuplinervis* Cogn. (end.; no. 662), and other Melastomataceae (nos. 639, 663), a *Cryptocarya* (no. 744), further species of *Conocephalus* (nos. 404, 467), *Ichnocarpus volubilis* Merr. (trop. S. E. As.—Austr.), f. *sogerensis* Markgr., a very prickly *Caesalpinia* (no. 474), a *Salacia* (no. 652), besides the menispermaceous *Stephania Zippeliana* Miq. (E. Arch.) and *Macrococculus pomiferus* Becc. (end.). We found here the climbing pandanaceous *Freycinetia* (no. 766), its sharply 3-angled stems pressed closely against the tree, while, just as in *Stenochlaena*, the branches of older specimens hang free.

[20] O. Karsten, Handbuch d. Natuurwissenschaften, III (1913), 685, art. Epiphyten.

A plant which, with *Faradaya* and the red-fruited *Piper*, often stands out, because of its colorful flowers, is a magnificent *Mucuna* with large orange-red inflorescences. More rare is *Tecomanthe ?dendrophila* K. Schum., with clusters of large pale lilac and red bell-shaped flowers. Other lianas here are the apocynaceous *Parsonsia curvisepala* K. Schum. (end.) and *Lamechites* Schlechteri* Markgr.*

Climbers may also occur among the herbaceous plants. In addition to a couple of cucurbitaceous plants, no. 468 and *Luffa cylindrica* Roem. (trop. O. W.; no. 472), encountered in the reeds along the river-banks and perhaps introduced, I found the convolvulaceous *Lepistemon urceolatus* F. v. Muell. (Austr.; no. 565) with still another representative of this family (no. 413).

The semi-parasites are represented by *Loranthus plicatulus* Krause*, a species with red-violet flowers.

I have already stated above that, in the epiphytic flora, the Orchidaceae especially and the ferns are very strongly represented. Elsewhere earlier, as an example of these riches, I have mentioned an instance in which I collected not less than 28 different species of flowering orchids in a half hour's time on a single branch of a river-bank tree. A number of non-flowering orchids occurred there too. That the two groups mentioned particularly occupy such an important place amongst the epiphytes is, according to Schimper,[21] owing to the smallness and lightness of their spores and seeds.[22] Thus they may easily be spread by the wind or just as easily fasten themselves in moss-cushions or in crevices in the bark of the host, where they happen upon enough water to enable them to germinate. Other families—provided that the plant is organized for an epiphytic way of life or at least can tolerate it—are selected on account of juicy fleshy fruits, which are eaten by birds and animals. The fruits of *Myrmecodia*, *Hydnophytum*, and the Loranthaceae are brought to the branches by being rubbed from the beak. Those of *Medinilla*, Zingiberaceae, Ericaceae, and many others are dropped in the excreta. A number of hemiepiphytes also may be placed in this category (*Ficus*, Araliaceae, Piperaceae). Thus firstly, the nature of fruits and seeds—organs often of very constant nature in a family, a fact explaining why some families furnish many epiphytes, others practically none—determines which groups of plants make the origin of epiphytes possible. Schimper theorizes that the plants of the forest-floor, which, no matter how, possessed an aptitude to continue in life as epiphytes, formed the first representatives of this group, and that adaptations did not originate until later.[23]

One of the most noteworthy plants of this group, although neither an orchid nor a fern, is *Trichosporum* (aff. *T. radicans* Nees, no. 419), with its clusters of fiery red flowers. Other members of the group are the peculiar myrmecophilous plants, such as *Myrmecodia* and *Hydnophytum commune* Val.* (no. 446), which harbor ants in the cavities of their thick tuberous stems, and their allies which occur in great numbers in the mountains. *Randia Gynopachys* Boerl. (Java, Celebes, N. Guin.) is another epiphyte here. The genus *Hoya* is also well-represented (nos. 592, 593, 653, 738).

As for the Orchidaceae, of all the families which occur here, it is surely the richest in epiphytes. Included here are a species of *Grammatophyllum* and

[21] A. F. W. Schimper, Die epiphytische Vegetation Amerikas—Bot. Mitt. aus den Tropen II (1888), 157.

[22] Schimper l. c. p. 21.

[23] Schimper, l. c. p. 29.

the stately *Dendrobium violaceoflavens* J. J. Sm., of which I observed a few specimens on the highest branches of an almost leafless tree. This remarkable orchid, with coarse attenuate leaves and fleshy lilac-speckled flowers in thinly arranged axillary inflorescences, stands upright on a branch of the host. One specimen measured 2.5 m. in length, but a much larger specimen, lost in felling the tree, must have been 4 m. long. By far the greater part of the epiphytic Orchidaceae, however, are small or even very small plants. Amongst these, particularly the genera *Dendrobium* and *Bulbophyllum* are strongly represented, as, for example, by *Dendrobium ostrinum* J. J. Sm. var. *ochroleucum* J. J. Sm., *D. angraecifolium* J. J. Sm., *D. rugulosum* J. J. Sm., *D. Baeuerleni* Krzl., *D. transversilobum* J. J. Sm., *D. Macfarlanii* F. v. Muell., *D. prestocaule* Schlecht., *D. anosmum* Lindl., *D. comatum* Lindl. var. *papuanum* J. J. Sm., and by *Bulbophyllum tectipetalum* J. J. Sm. var. *longisepalum* J. J. Sm. and *B. ensiculiferum* J. J. Sm. Of other genera I mention *Eria Lorentziana* J. J. Sm. & Krzl., *Robiquetia Mooreana* J. J. Sm., *Sarcochilus Moorei* Schlecht., *Podochilus scalpelliformis* Bl., *Sarcanthus bicornis* J. J. Sm., and *Schoenorchis plebeja* J. J. Sm. One of the very small epiphytic orchids is a curious leafless species of *Taeniophyllum* in which the roots, having taken over the function of leaves, lie pressed flat against the host-branches and radiate in all directions, whereas the small flower-stalk rises from the junction of the roots. *Taeniophyllum tamianum* J. J. Sm. and *T. tripulvinatum* J. J. Sm. were found here also.

The number of epiphytic ferns, as noted above, is very large. Again the small forms are in the majority. Many of them have a wide distribution, the result perhaps of the lightness of the spores, which are easily spread by the wind. They possess this phenomenon in common with many higher fungi, but it is not easy to understand how toadstools living on the floor of the primeval forest can be spread through the medium of the wind. The seeds of the Orchidaceae also are unusually light. That widespread plants within this group are much less numerous is perhaps a consequence of the circumstance that these seeds on germination must meet particular conditions not found everywhere (mycorrhiza).

Examples of such a widespread distribution are: *Humata Gaimardiana* Sm. (trop. S. E. As.—Polyn.), *Pleopeltis phymatodes* Moore (trop. and subtrop. O. W.), *Polypodium verrucosum* Wall. (Arch.—Austr.), *Asplenium tenerum* Forst. (trop. As.), *Loxogramma involuta* Fr. (Arch.—Polyn.), *Merinthosorus drynarioides* Copel. (Arch.—Polyn.), and *Hymenolepis spicata* Pr. (Madag., Mascar., trop. As.—Polyn.).

No matter how common, an always attractive plant is the elegant *Ophioglossum pendulum* L. (trop. As., Austr., Polyn.), which occurs as a pendent epiphyte along river-banks and above damp places. The single leaf hangs down slack and long like a broad dark green ribbon, while out of the middle the thick knobby cylindric sporophyll appears. A superficial likeness with this species of *Ophioglossum* is shown by certain members of the genus *Vittaria*. The numerous leaves (as expressed in the generic name) are ribbon-shaped, but the sporangia are found in the longitudinal split of the leaf-margin. I here found *V. ensiformis* Sw. (Java, Sumatra, Mascaren.), with a peculiar interrupted distribution reminding us of our incomplete knowledge regarding this area.

Another group of epiphytes, the beautiful Lycopodiaceae, are frequent on lower parts of tree-trunks. Some species native in the coastal lands and lower

mountain-regions hang down as a dense light green mass, such as *L. subfalciforme* v.A.v.R., which is indigenous here. In the higher mountain-regions we shall come across a larger number of terrestrial representatives of the genus.

In places where the banks are steep, mostly through erosion on account of the stream and therefore on the outside curves, the high trees at the water's edge form the margin of the forest assailed by the river. On the more level inner curves narrow strips of reeds occur here and there. In the vicinity of Pionier-bivak, where one can notice already the influence of the foothills of the van Rees Mountains, the strips are narrow. But nearer the coast, and similarly in the Meervlakte, as we shall see, the reed-fields cover large areas. In so far as I could determine, these communities consist mainly of two species. The one chiefly dominant is the large *gelagah* (*Saccharum spontaneum* L.[24]), a robust plant often 9–10 m. high. Among these plants I found frequently the smaller *Phragmites Karka* Trin. (no. 773), not taller than 3–5 m. Both species possess beautiful fine panicles. Sterile specimens of the two species can be distinguished from each other by their stems, those of *Saccharum* are constantly solid and have bamboo-like thickened nodes, whereas those of *Phragmites* are hollow. Furthermore, the leaf-margins of the second are much less roughly hairy than those of the first.

Before we step into the proa and permit ourselves to be brought over the rapids to the Meervlakte by our never sufficiently praised wilderness companions, the Dyaks, and before going from there into the unknown mountains, a few words on the impression of primeval forest life must be inserted. For some impressions are worthy of remembrance and, in spite of some disagreeable ones, make us always desirous of returning again to this immense and grand country. Magnificent with respect to its dimensions of forest and river, even when one looks upon them at close range, grand in its virginity and its proud silence at the intrusion of people who will at some time conquer the country, it will persist until man also shall have vanished and his influence shall have been lost forever.

Many memories bind us to each small place that we have visited: this is stronger still in the mountains, where so many more influences coöperate to that end. The Mamberamo navigators will ever see before them the broad muddy river with its numerous curves, the still, high forest-walls, the translucent morning mists which hang without motion in the treetops until 8 or 9 A. M. They will feel the heat vibrate above the river-banks at midday and again sniff the heavy damp odor of the forest, evidence of the incessant progressive decay of organic material. Again the melancholy cooing of doves will be heard at regular intervals high up in the tree-tops, frequently also the noisy cry of the hornbills, which are hardly seen amongst the mass of leaves and branches until, with the harsh flapping of their wings, they fly away. Then we see again their dark silhouettes before us as they depart, frequently in pairs, over the river, and the screaming cockatoos with their blunt heads and swift wing-beat, which in the evening at the fall of twilight come in large flocks to sleep in the trees. Some will bear in memory the distant hoarse cry of the cassowary. Sometimes too it is the distant howl of a Papuan dog that comes hovering over the water by the river.

[24] Unfortunately I neglected to collect material of this species, so that the identity is not scientifically certain. This mistake has been made by many collectors before me. The grass is usually considered too common to justify the difficulty in collecting it, and hence the exact distribution of *S. spontaneum* L. is not definitely known, although this may be a strange remark to make about such a widely distributed and common species.

The bivouac life itself has also left behind many memories; the numerous interests of the expedition, the water-level, the daily results of the work, the members, the happenings in camp, the life and work of the convicts, the soldiers, and the Dyaks, the making of proas, the regular departure of transports toward the interior and then, frequently too late, the boat, which one morning entirely unexpected came steaming around the distant bend of the river and brought all camp-dwellers to attention.

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The ascent with the proas has been described too often for me to weary the reader with a new detailed description. I shall therefore limit myself to a few comments and the insertion of a few maps which I made of this part of the Mamberamo (cf. Map A, Fragm. I).

The ascent via proa by our expedition lasted three and a half days, but in normal circumstances it should be possible to make it in three days. On August 8, 1920, I started with the geologist from Pionier-bivak. We traveled along the right bank. Sometimes there is paddling, but mostly the Dyaks make use of all kinds of projections on the bank or even trees overhanging the bank to tow the proa forward with their hooks. At Havik Island the inner bend of the river is taken; after that we come again into the main river, which temporarily maintains the same aspect. Sometimes we stop and rest for a little while on a small boulder-strewn bank, and sometimes a few Dyaks go into the forest to get rattan or to try to shoot some animal or bird for a meal. A little later we choose to do some cooking and bathing, but at 2 o'clock we still are at Tulband-bivak, named thus after a conglomerate formation that, as a forerunner of the Marine Falls, lies in a little narrower stretch of the river and somewhat resembles the form of a turban. On the left bank is a spit of land, formed by a small tributary which empties here into the main river. Somewhat farther upstream lie naked marl rocks washed bare by the water, so that there is room and a good place for a camp. Apparently this is one of the places where the andesite formation,[25] of the younger sedimentary rocks, broke through, and on account of their hardness these rocks have offered more resistance to erosion by the river. They are the cause of the rapids. At this point the river is much constricted and small rapids rush to the other side. Here already the hills come much closer to the river; there are no flat areas of importance and in many places this bare sedimentary rock-formation reaches the river.

The forest has kept the same appearance along the way. I recognized repeatedly the same trees and lianas, on the bank, which I have already mentioned above. The large number of landslides of all ages which one sees in the vicinity of Tulband-bivak is striking. Some come as far as the bank, and the younger still show the chaos of loosened blocks of stone, while in all directions tree-trunks stand obliquely and between them the light green color of tall herbs and young trees shows.

On the sandy point by the bivouac I found a very dense growth of a fern, *Nephrolepis hirsutula* Pr., mixed with sparse stands of *Phragmites* and shorter grasses. Scattered here and there were specimens of *Euphorbia serrulata* Rw. (trop. S. E. As., Austr., Polyn.) and *Spigelia anthelmia* L. (introd. from trop. Amer.).

[25] According to van Gelder, l. c. 92–93, pl. XI, XII, the rock-formation at the entrance to the rapids at Tulband-bivak is andesite; at the Marine Rapids sandy marl; at the Edi Rapids andesite; and at the Batavia Rapids sandstone.

The following day we pass the rapids. Shortly after we have left the bivouac we see the Marine Falls lying before us at the bend of the river (*Fig. 3*). The river is here narrowed by a large number of rock-masses, the largest of which are overgrown with small trees; above is a wide basin of calm water and in the distance the characteristic small sharp point appears. This rises steeply close to the bank and forms the forerunner of the formidable Edi Falls and itself causes a narrowing of the river-bed. Close in front of the rapids we cross the river, so as to make our way up along a large loose mass of boulders—the first of significance—situated near the left bank. With the swift current to the right of us everything goes smoothly and a half hour later we slip in below the great calm where all the driftwood and other vegetable-refuse gyrates slowly in a large circle. After that it is calm along the boulder-bench, where a number

FIG. 3. Marine Rapids; view looking upstream.

of beautiful specimens of purple-flowering *Desmodium heterocarpum* DC. (trop. As., Austr.) stand. After we have passed the small sharp point, a straight stretch of river lies before us, but the banks are full of indentations, each of which forms a pool of counter-current, and these stony spits each cause a small rapid which must be overcome. Steep hills with bare rock walls rise high here and there on the left bank. They are the andesite hills, which, according to van Gelder, have brought about the origin of the Edi Falls (*Fig. 4*). Along the right bank the sedimentary rock-formations still border on the water, but now they sometimes lie flat, although a little farther on they appear to incline and project in a zig-zag manner (*Fig. 5*). The Edi Rapids are violent but short. Here there is only a narrow gateway between steep walls, on the right bank partly obstructed by a large number of rounded boulders. Just below the falls the passengers and the cargo are taken from the proas, whereupon the Dyaks, some with their proas on one bank, some on the other, pull up the empty

boats. At 2 o'clock we reach the small bivouac lying on the upstream border high against the steep slope. Since noon the earlier fine weather has become rainy and windy, and shortly after a tributary, which empties into a wide basin above the rapids a short distance from the bivouac, begins to swell and empty its muddy water with much driftwood into the Mamberamo. This camp is pleasantly located with the view of the river (*Fig. 6*), but the pleasure is somewhat spoiled for us by a stormy night. The wind coming through the narrow entrance of our shelter made us afraid of two old dead trunks which stood close behind the camp.

The third day we followed a long and calm part of the river. After some hours of rowing we rested, and after we had again departed we met a proa with Papuans, the second on this trip. Without any striking events, the last camp was reached at quarter-past three. This was named Wand-bivak because of a

FIG. 4. Mamberamo between the Marine and Edi Falls, view looking upstream; on the left bank are andesite hills, on the right sedimentary formation.

high horizontally deposited rock-wall, which rose perpendicularly behind the little bivouac. Not an hour later one of the heaviest cloudbursts which I have ever seen in the tropics broke. A thick curtain of pouring rain surrounded us and came through the thatched roof, permitting nothing to remain dry. So we sat hours on end, altogether motionless. The darkness fell early. On the other side is a terrace about 10 m. high, formed by a horizontal layer of stone, and from that thundered downward some wild waterfalls. From near at hand we heard the landslips rattle, and at times in the neighboring forest an enormous tree crashed to the earth with a dull roar and an ominous cracking of the wood, which sounded above the noise of the rain and the waterfalls. With great difficulty we light a candle-lantern and by the flickering light see outside the naked shining bodies of the Dyaks busy pulling the boats higher and bringing the cargo to safety, fearful lest everything would drift away with the sudden rise of water. But toward 8 o'clock the rain lessens a little, and we try to make a fire. The thick smoke has no effect on the swarms of mosquitoes, which

appear as a forerunner of the large swarms of gnats in the Meervlakte. It becomes necessary to stretch our wet mosquito netting, which we had not needed in other camps. Thus the really small discomforts of wilderness life alternate with many moments of happiness derived therefrom, and when the following morning in a decreasingly drizzling rain we sat in the boat and watched the sun slowly come out, all the distress of the previous night was forgotten. Sometimes we follow along the high terrace on the left bank, from which even now small waterfalls tumble down. Along the other bank extends a similar terrace. The vicinity of Wand-bivak is obviously characterized by an almost horizontal position of the strata. Along the bank here one frequently sees a curious stone-formation. It seems as if the rocks consist of a number of joined boulders, each surrounded by one or two thin layers

FIG. 5. Exposed layers of sedimentary formation along the bank of the Mamberamo.

which cover them like a rind. Sometimes the upper surface is bulged so that one obtains the impression of a weathered convex shell. In other places we see the same formation worn smooth and therefore cut through, the upper surface then rather suggesting fossilized "suncracks." In many places a piece of rock-wall stands perpendicular to the water, and sometimes we pass a stream that has cut through the rock-formation and formed a narrow, winding, and dark canyon with exactly perpendicular walls.

As we near the Batavia Rapids, the incline becomes greater everywhere and the stream swifter. At nine o'clock we rest a short time on a large boulder-strewn bank at the inside of the bend which still cuts off Batavia Falls from our view. The Batavia Rapids consist of a long series of ledges (sandstone according to van Gelder) which spread out over a long and broad bend of the river. At quarter past five we cross one uplifted reef after another at the inside curve, while on the other side the swift main stream flows rapidly with

large waves. Already the hills on the banks are lower. They continue to withdraw, and finally the river is calm and broad again. Another bend, and the wide Meervlakte lies before us, the marshy area 300 km. long and 60 km. broad. In recent geological time, it must once have been a large lake, which drained gradually as the Mamberamo cut itself deeper into the threshold of the van Rees Mountains. Even yet one finds there large pools, and the river flows

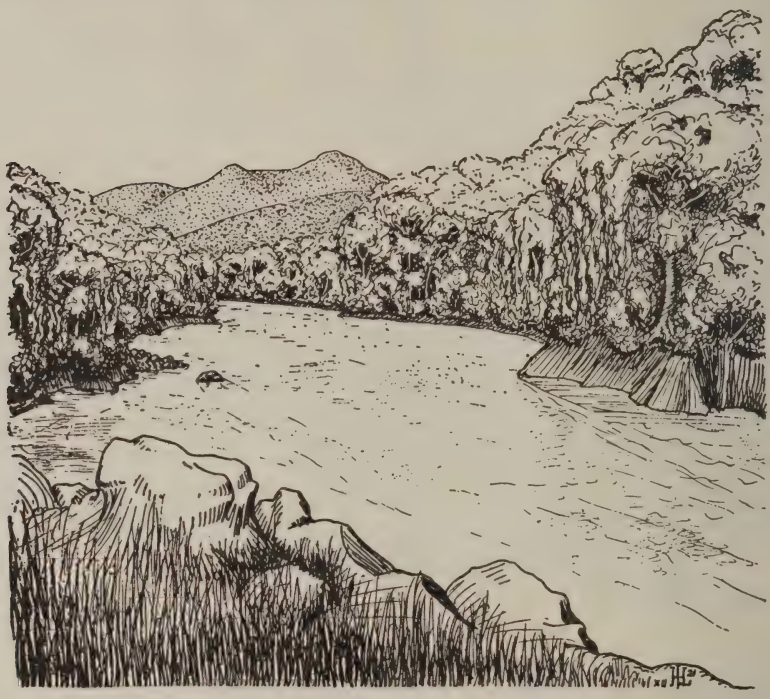

FIG. 6. View from Edi-bivak, looking upstream.

slowly in wide curves over the thick clay-formation. When this terrain began to drain, vast reed-fields appeared on the gently sloping banks as pioneers of vegetation. On the driest places these gradually are replaced by a thin and low forest, and the Meervlakte itself is covered with a characteristic marsh-vegetation which diverges considerably from that of dry land. An ensuing Fragment must be devoted to the impressions which I obtained of this remarkable terrain.

IV. The Meervlakte and the foothills [1]

THE PREVIOUS Fragment [2] has brought us through the falls of the Mamberamo to Batavia-bivak, situated on the north side of the Meervlakte [3] against the southern spurs of the van Rees Mountains. In passing, as is mentioned at the close of the last Fragment, the Meervlakte—the largest of a few similar low-lying basins which lie north of the Central Range—was probably a lake in geologically very recent time, the level of which fell gradually, as its drainage system, the Mamberamo, cut deeper into the outlying extensions of the van Rees Mountains. This process is at present undoubtedly still in full swing. Now we find here a vast marsh, neither land nor water, in which the river flows slowly with slight fall, wide meanders, and continually changing bed. As the water-level lowered, the reed-border must have gradually encroached towards the center of the lake. Little by little the river then began to form a gully or rather gullies in the alluvial land. As the water fell still more, the stream, beginning at the highest point, built up its own levees and has continued that process up to the present. The banks thus formed became the first habitat of the higher flora. Still, however, a large part of the Meervlakte is deep marsh and even in the dry season there are large bodies of open water. But in the rainy season, while the barriers in the river-bed hold back the water for a little time, undoubtedly vast portions of this plain are inundated, and one may suppose that the height of the natural levees agrees with the average highest water-level. I had opportunity again and again to observe proof of this. The development of similar natural levees occurs in all rivers whose level is subject to periodic change, and which flow through territory suitable for their formation. The stagnation during the period of high water causes a deposit of alluvium at that time. We might then also expect to find such levees along periodically flooding rivers, and in such streams as the Mamberamo, whose course is interrupted by natural basins in which the highest water-level is maintained longer than would otherwise be the case. Naturally the first-mentioned is the most common. We find this true of all rivers in flat alluvial land.

Some fleeting impressions gathered while traversing the flat land by boat—three days of travel with the little motor-boat from Batavia-bivak to Prauwen-bivak—may here follow. After that we shall dwell more fully on the vegetation in the vicinity of the latter bivouac. In the first place we shall discuss the peculiar marsh-growth of that part of the Meervlakte, in order that, thereafter, as a means of transition to a following Fragment, we may still mention something concerning the flora of the foothills.

At 7 o'clock on the morning of August 12, 1920, we left in the motor-boat from Batavia-bivak. The stream here flows slowly, not more than two miles an hour. The river is several hundred meters wide and in most places bordered by a narrow *gelagah* [*Saccharum*] strip. On our left the foothills of the van

[1] Natuurk. Tijdschr. Nederl.-Ind. **88**: 187–227. 1928.

[2] This Tijdschrift LXXXVII (1927), 139.

[3] J. K. van Gelder, Verslag omtrent eene geologische verkenning van de Mamberamo-rivier op Nieuw-Guinea—Jaarboek van het Mijnwezen in Ned. Oost-Indië, XXXIX (1910, published 1912), 99 et seq.

M. Moszkowski, Expedition zur Erforschung des Mamberamo in Holländisch Neu-Guinea—Zeitschr. d. Ges. f. Erdkunde, 1912, 366 et seq.

Rees Mountains still rise, but when we have rounded a bend, the Meervlakte in all its majesty lies before us. We leave behind the dark quiet of the van Rees Mountains under the now rising mists; more to the east we see the higher peaks of the Gauttier Mountains (*Fig. 7*), but before us on the southern horizon high cloud-banks point the direction in which we have to look for the mighty Central Mountain Range. The stream here becomes wider and wider and on the lowest part of the plain is a kilometer wide. The forest of the bank is low and ragged and over large areas is pressed back by wide *gelagah* [*Saccharum*] fields. Wherever the forest comes to the bank we notice that woody giants are very rare; many spots on the outside curves have been laid waste by a recent freshet; already the stream is actively changing its bed, eroding its banks, and depositing mud in other places. We pass a woody giant of which half the root-system already protrudes outside the denuded bank. With another flood the tree will fall into the river, and its trunk will speedily form a part of the high wood-piles

FIG. 7. Van Rees Mountains (left) and Gauttier Mountains (right), seen from the Mamberamo.

which one sees here and there along the bank. The muddy banks lie stretched out on the inside bends, so gently sloping that one scarcely can see the boundary between the gray slime and the dirty brown river. Gray as the mud, several large crocodiles lie parallel with the water-line in the sun. Some remain in place, others glide noiselessly into the water as we pass. Once we saw a couple of very young ones above the water on a branch jutting out over the river. On the outside curves, the low forest, frequently without a *gelagah* [*Saccharum*] strip, comes to the water's edge. With the deeper water, the steep muddy wall rises about a meter above the river. On straighter stretches the forest frequently alternates with sago-thickets, a marshy transition to the *gelagah* [*Saccharum*] covered banks only on the inner bends, behind which the forest begins.

Little by little the day became brighter, and toward 11 o'clock the high peaks of the Central Range lay cloudless before us (*Fig. 8*); only the base was still surrounded by a thick fleecy low mist. Almost directly south we saw the mighty summit which Doorman climbed in Nov.–Dec. 1914, and which height

at that time he placed at 3810 m. (a later measure gave an average of 3580 m.). To the left of Doormantop, which is recognized by a small indentation at the highest point, lies the "4050" summit, correctly about 3820 m. altitude. The low saddle between the two, with the flanks of both mountains toward each other, forms the source of the Doorman river. East and west of these two towering peaks the mighty mountain range stretches out as far as we can see.

At quarter-past one we reach the junction at Kalong Island, where the Idenburg River out of the south and east and the van der Willigen River out of the west unite and, under the name Mamberamo, flow to the sea. Both branches are of about the same width, but the westerly one makes a stronger impression. For another half-hour we go on, then land on the left bank at Kalong-bivak.

This noon I had the opportunity of glancing at the surroundings of this little bivouac. The land here is entirely flat, first sloping inland very gradually, then somewhat more abruptly, finally changing into a marsh. The forest, in

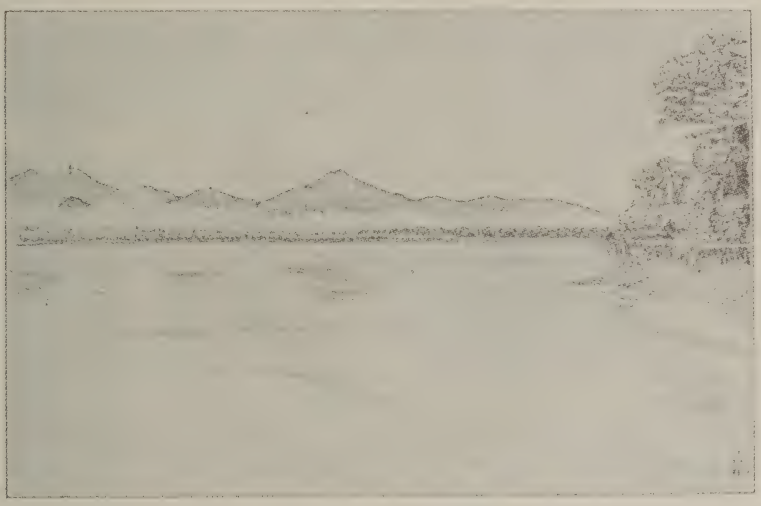

FIG. 8. Doormantop (middle) and 3820 m. peak (left), seen from the Mamberamo.

comparison with that of Pionier-bivak, is strikingly rich in bird's nest ferns (*Asplenium nidus* L.), which are on almost every tree. In this terrain also we make our first acquaintance with a locally very common but poisonous snake (*Acanthophis antarcticus*), a short broad reptile with a much thinner tail and broad head. According to Ouwens,[4] the poison is very dangerous but the reptile does not seem to be aggressive. It is said that this snake tempts small animals within range by lying coiled up and making its slender tail quiver. In the forest we are tormented by swarms of mosquitoes and a great number of buzzing flies which, however, disappear toward evening. Quietly the river flows along past us, many small white terns (probably *Sterna minuta*) dart quickly over the smooth water or allow themselves to be carried along sitting in a row on a drifting tree-trunk. Toward dark it is evident that the name of this bivouac is well chosen: enormous numbers of *kalongs* (fruit bats) fly over from the northeast to the southwest.

[4] P. A. Ouwens, De voornaamste giftslangen van Nederlandsch Oost-Indië (Leiden, 1916) p. 15, pl. IV.

The second day of the journey, we are again on the way at half-past six. On higher places along the bank we see many breadfruit trees (*Artocarpus* sp.) and a palm (*Kentia?* sp.), called *niboeng* in the eastern part of the Archipelago, and in lower lying places much sago and *Pandanus*. The levee along the banks now and again is lower, and there the marsh comes almost to the river. At some places it is even interrupted and we pass along vast reed-fields. Probably these are the spots where old cut-off stream-loops have become filled with sand and thick mud. Later we saw from the mountain that all the land in the vicinity of the river was traversed by a number of similar lagoons, frequently many kilometers long, cut off from the main stream. Of these, both previous connections with the river were silted up. On the younger of these filled-in spots, a *gelagah* [*Saccharum*] community has already developed. The older ones are overgrown with forest and therefore are never visible from the river. Flocks of *kalongs* repeatedly fly out of a few isolated trees in such *gelagah* fields.

We come across few signs of inhabitants. At 9 o'clock we pass an abandoned hut, and, after traveling through a long stream-meander which almost doubled back on itself (one of those which in the near future will be cut off), at ten-thirty we come to a kampong of ten houses. There also stand two small huts belonging to bird-hunters, and many queer-shaped proas, these, like the inhabitants, gray as the mud of this territory.

Shortly after leaving this kampong we meet one of the peculiar proas such as we saw only in the Meervlakte. They are hewn out of a heavy trunk, the bottoms broad, the body rather deep, the sides sloping inward and supplied with narrow openings, the upper part narrow. The bow and stern are cut off transversely, therefore, seen from the front, they appear to be blunt; seen from above, however, they seem to be narrow. Perhaps this form was developed because of the unfriendly attitude of different tribes along the river. The crew can conceal itself entirely behind the sides and keep an eye on the opponents through the holes. As we saw them, there was always one of the rowers sitting on the prow, one leg hanging over the water, the other bent up under him, the boat being propelled by a long oar with a small round blade. Most of the boats showed signs of long use. Frequently there was almost nothing left of the thin sides. A few times we happened upon such boats lying idle or proceeding very slowly with a crew of two or three Papuans. Sometimes they caught fish and roasted them over a little fire in the middle of the boat; sometimes we saw a thin column of smoke hanging above the water of the reed-field. Some had a few scrawny yellowish dogs, with which they had been hunting. At 11:30 A. M. we pass a small hut with three Papuans. At one o'clock we see a small abandoned house; beyond all is loneliness and wilderness. At three o'clock Veen-bivak is reached; it derives its name from a small side creek with clear brown fen water. Later Lieut. Droog, who had a free proa at his disposal, discovered a large fen lake, 2–3 km. in diameter, a few hundred meters from the river. Reeds bordered the lake and many water-birds inhabited it. Among others he saw cormorants, which we also saw later on the Doorman River. The lake was very shallow at the margin, but in the middle the bottom could not be seen. Several creeks empty into this lake.

The forest in the vicinity of the bivouac shows a similarity with that of Kalong-bivak. A large number of breadfruit trees occur here. Near the edge of the marsh we see many tracks of pigs. A pure stand of *Cordyline terminalis* Kunth grows about 4 m. high. It has branched ribbed stems, from which

here and there conical aerial roots a few decimeters in length hang down. Beyond this zone the marsh becomes flat. It supports a community of *Scleria elata* Thw., with sharply 3-angled stems and 3-winged leaf-sheaths, about as tall as a man.

Just as on the first two days, so on the third day we start early. The daily morning mists rise speedily and allow the sun considerable play over the almost Dutch landscape. At seven-thirty we pass some tiny abandoned huts and a half-hour later a proa with three Papuans and a dog. At half past eight four small huts and a small banana-plantation, over which an old man keeps watch, are observed. Sometimes we pass by the mouths of large side-creeks or rivers, all on the left bank, and therefore on the side toward the mountains. Along the broad muddy banks walk beautiful black and white herons, and also smaller white birds on high stilt-like legs. We see many places which lead us to presume that they were earlier entrances to old loops of the stream. At 12:30 we

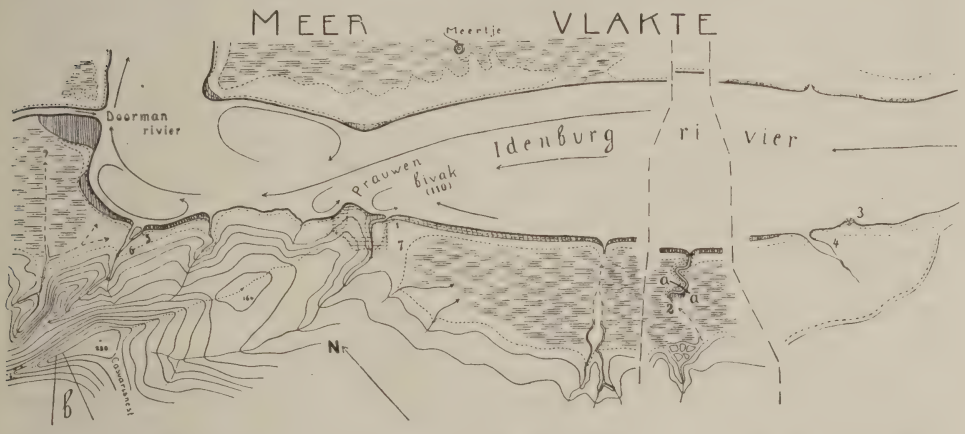

Fig. 9. Sketch map of the vicinity of Prauwen-bivak; the long uniform river-section southeast of the bivouac is twice broken on the map, for simplification; the stippled line indicates about the average highest water-level; the other lines are at 10 m. intervals; horizontal hatching = bivouac; vertical hatching = *Saccharum* fields; altitude in meters; explanation of letters and figures in the text; . . . = trail; meertje = small lake.

go by the mouth of a small tributary with clear fen water, and an hour later, also on the right bank, we approach a large inhabited kampong of not less than 12 houses. On the bank we count 13 proas.

The foot of the mountain, visible under the clouds, comes steadily nearer; several details in the outline grow more distinct. The clouds are lifting somewhat and the beautiful 1050 m. summit south of Prauwen-bivak is visible. Along the left bank on the upstream point of a small island, we see a high pile of accumulated driftwood bleached in the sun, and shortly after that the mouth of the Doorman River. The clearer and cooler water of the latter immediately disappears under the dirty and warmer water of the main stream. Prauwen-bivak lies directly ahead, near a steep hill. At two o'clock in the afternoon of the third day we have reached the far side of the Meervlakte.

With the aid of a sketch map (*Fig. 9*) we shall therefore subject to a closer consideration the different terrain- and vegetation-forms in the vicinity of the bivouac.

In the first place, on the other side of the bivouac I can study much of the vegetation of this part of the Meervlakte, and elsewhere certainly again other forms of vegetation will occur. Similarly there is a forest-margin (cf. *Fig. 10*) in the neighborhood of the small temporary bivouacs, and lying behind it a more or less open marsh. The ground of the forest-margin is highest immediately bordering the river and is extremely regular and flat. For the tropics, the forest has a very unusual aspect. The undergrowth is almost entirely lacking there. Occasionally the thick winding stems of a few lianas swing in great loops between the trunks, but the trees are widely spaced and one is not hindered by the great mass of young trees, shrubs, rattans, and screw-pines which one meets on higher terrain. This all gives one the impression of an almost European vegetation and it is even more so if the ground be covered with a community of grasses and small herbs.

The boundary of the higher forest coincides with the average highest water-level; consequently the high forest is lacking wherever the terrain is lower near the bank. Thus the appearance of the vegetation is clearly influenced by this limiting factor, the water. The soil consists of a compact clay which, nevertheless, does not extend high enough to dry out sufficiently and thus allow the requisite amount of oxygen for plant-growth. In the dry season—though in the equatorial region not strongly pronounced—the forest-margin only is dry. Beyond that lie, at least in this region, vast pools and marshes with clear brown fen water. But as the rains occur in the mountains, the river-water rises higher and higher, the clear fen waters apparently are expelled by the muddy water of the river, and at the highest water-level the forest-margin also is under water. Then over the entire terrain a new muddy layer is deposited, and repeatedly I saw the traces of it upon tree-trunks and branches at a height above the ground which astonished me again and again.

This continual saturation of the ground results first of all in retarding the respiration of plant-roots. Some species cannot withstand such obstacles and are restricted to drier stretches. Consequently a strong limitation in the number of species is an important result. The plants which can endure the abundance of water show, although of course in lesser degree, adaptations such as are known to us in the case of the mangrove. Many possess a spreading superficial root system, a factor which likewise is the cause of the thinness of the forest. Another adaptation is the possession of true respiratory roots, such as are met with in other fresh water marshes (e.g. in Central Sumatra). The most noticeable example of this I found in a rattan species (apparently a *Calamus*). The small forked gray-brown respiratory rootlets of this plant project in thick and broad radial rows on the naked and muddy base of the trunk at a distance of about 7.5 m. above the ground. So far as I know, respiratory roots have never before been observed in any species of rattan. True, they are already known in a number of other palms and in many dicotyledons of fresh water marshes. For further particulars concerning these rattan pneumatophores I refer to my article published [5] elsewhere. There are also in this terrain a few other plants which in a similar manner provide for the deficit of oxygen, from which their root-systems suffer. Many woody plants in such a terrain possess very large lenticels on the exposed parts of roots and on the lower parts of the trunk. Sometimes these are grouped particularly on

[5] H. J. Lam, Ademwortels bij Palmen—Handelingen Derde Ned. Ind. Natuurwetensch. Congres (Buitenzorg 1924), p. 318 and 477.

stilt roots (another resemblance to mangrove plants) or on aerial roots (analogous to the mangrove plant *Avicennia*). For instance, I observed the first here in a few *Barringtonia* species. The previously mentioned *Cordyline terminalis* Kunth, with its conical aerial roots, and the *waroe* (*Hibiscus tiliaceus* L.) especially present beautiful examples of the second. *Hibiscus tiliaceus* L. is unusually common in this locality. In dry habitats there is no trace of aerial roots to be seen, but on marshy ground thick bundles of these slender roots protrude from the obliquely standing trunks or overhanging branches. One can thereby observe that these aerial roots, all at the same height above the ground, are abruptly and strongly branched; without doubt this is the direct influence of the water and also a new indication of the height to which the river-water can rise and at which level it apparently remains for some time. One could occasionally observe a new level of weaker branching at the lowest water-level in this particular place. It is noticeable by the recently formed roots that any cork-formation fails to appear under water, whereas the root-parts between the two levels of branching show a weak development of cork.

FIG. 10. Schematic cross-section through the forest-margin of the Meervlakte from the river (a) to the marsh (t); explanation of the other letters in the text.

Here the terrain slopes gradually inland, sometimes with small terraces. The trees become lower and in this strip we meet with the above-described adaptations. Reeds and grasses mingle little by little with the undergrowth.

The inner forest-margin is unusually rich in forms, a fact especially noticeable in comparison with the poor outer margin, where only trees and lianas form the over-growth. In the sunny marginal zone between forest and marsh the ground is covered with a thick stand of *Phegopteris prolifera* Kuhn. The margin is very irregular: here the reed-formation juts into the forest, there a dry spit of forest land projects into the marsh, and everywhere small runways, apparently made by pigs or crocodiles, extend through the more or less broad stretches of reeds.

Let us look at the flora of this area a little closer (cf. *Fig. 10*), proceeding up the muddy shore of the river until we have reached the marsh. Beyond the strip of smaller level-changes of the bank, we find here again and again mud-pyramids (*Fig. 10, b*) of beautiful form on flat parts of the muddy beach. They

arise because the perpendicular downpour of tropical rain washes away the mud around one object or another, frequently a fallen leaf, sometimes branches, small fruits or stones. Then small weak conical columns form, of which a transverse section is very similar to the covering and of which it presents each irregularity of the margin. Older ones may be 10–15 cm. high, but even they are dependent on the water for their existence since, after an extended drought, they may be washed away by rains which destroy them. Above the stretch of these peculiar forms along parts of the bank not subject to direct eroding-action by the stream, we find the previously described reed-community of *Saccharum spontaneum* L. and *Phragmites Karka* Trin. On the steep bank of outer bends, the ground is frequently hidden under a cover of liverworts (nos. 847, 1091), among others, *Anthoceros*. As soon as we have overcome this last obstacle, we find ourselves in the margin of the woods. A number of small trees stand near the bank and lean more or less over the water. A single forest-giant (*Fig. 10, d*), with pillar-shaped trunk and enormous broad crown, stands far above the other trees. Among the smaller trees are a few species of *Ficus* (nos. 844, 1101) and *Vitex glabrata* R. Br. (S. E. As.—Austr.). Two species of the taller trees in the forest are particularly abundant: *Dillenia calothyrsa* Diels* with cinnamon-colored trunk, large leaves, and large yellow flowers, and the previously mentioned breadfruit tree (*Artocarpus* sp.). *Dillenia* prefers the drier parts of the forest margin, whereas *Artocarpus* seems to be more common on damp ground. This tree also occupies the marsh in the drier parts.

Here and there stems of rattan-palms occur between the trunks of these trees, also other lianas, such as *Flagellaria* and *Entada scandens* Benth. (no. 1154, pantrop.), the latter having pods more than a meter long hanging high in the trees. Occasionally there are some tall specimens of *Pandanus* (*Fig. 10, g*). The forest-floor beneath the taller plants is very poorly covered. On most spots other than the many dry leaves of *Dillenia* and *Artocarpus* one can see nothing except the dark gray compact clay. On similar terrain a small terrestrial orchid is common: *Vrydagzynea elongata* Bl. (end.), a low-growing plant with white inflorescences. More toward the sunny side of the marsh there are small communities of *Leptaspis* (no. 788), *Panicum* (no. 899; *Fig. 10, 1*), and other grasses (nos. 835, 1133). *Helminthostachys zeylanica* Hook. f. is plentiful but always occurs on damp terrain. In the drier parts of the forest-margin, shrubs and other representatives of the low flora are almost entirely absent. In addition to the small orchid already mentioned, here also occur the araceous *Schizocasia acuta* Engl. and scattered specimens of the pretty amaryllidaceous *Crinum asiaticum* L. (no. 1002; trop. As.—W. Polyn.) (*Fig. 10, e*), the latter reminding one of the beach, if it be a sandy beach, on which the plant ordinarily occurs. It is a coarse but stately herb with a thick rosette of leaves pointing obliquely upward and crowning the bulky black caudex; from the center of this the robust inflorescence with its umbel of narrowly lobed white flowers projects. The only shrub which I found here was *Morinda bracteata* Roxb. var. *celebica* Miq. (*Fig. 10, i*).

As the terrain slopes to the marsh, we find much lower trees 10–15 m. high, a few with prop-roots (*Fig. 10, h*). These trees obscure the inner margin of the real forest, but farther inland we note the richer flora of the marsh-border. Among these smaller trees a couple of species of *Barringtonia* are fairly abundant, *B. acutangula* Gaertn., with fragrant rose flowers, and another species related to the common *B. racemosa* Bl. of the sandy shores and *B. acuminata*

Bl. of Borneo; this species too has rose flowers in a somewhat pendent slender raceme. Another small tree, *Syzygium megalanthelium* Diels*, likewise with rose flowers and striking on account of its light-colored trunk, is generally distributed here.

Fungi, as is to be expected, flourish in rich variety (nos. 845, 903–5, 1089, 1093–4, 1142–3, 1152). I found *Polyporus grammocephalus* Berk. among others on dead wood. A couple of species of moss were also collected (nos. 848, 1092).

Without doubt, however, the most interesting part of this terrain is the strip forming the transition from the forest-margin to the marsh. Particularly in places where the transition is gradual on account of a slow and regular decline of the ground, the different zones are well-developed and sharply separated, and I noticed the same sequence at the transient small camps between Batavia-bivak and Prauwen-bivak. Still in the shade of the last low trees, *Cordyline terminalis* Kunth begins to appear. The thin stem stands more or less obliquely, and the narrow leaves are crowded and directed upwards at the apices of the branchlets, the large thin inflorescences and infructescences being pendulous. It has globose dark purple fruits. Somewhat farther in but still in the shade, there follows an even more sharply defined area dominated by a plant with equally striking habit, the zingiberaceous *Tapeinochilus* (aff. *pungens* Miq., no. 926; *Fig. 10, m*). The stem is smooth, articulate, and upright. Its aspect suggests that of a bamboo stem but it is herbaceous, massive, and fleshy. It rises unbranched to 2.5 or even 3 m. At the apex it bears an enormous ovate inflorescence, about 3 dm. long and 1.5 dm. in diameter, consisting of a thick axis beset with hard shining prickly bracts, which are dark green at flowering time and dark brown in fruit. These bracts entirely enclose the strongly flattened flowers, except for a small portion of the corolla. The calyx is greenish white, changing to red at the apex, the corolla is a pretty golden brown; the whole inflorescence gives somewhat the impression of a large pineapple. Under these inflorescences, lateral branches about 2 m. long radiate at a wide angle from the vertical which, like the main stalk, are bare, but at their apices they are again branched in the same way. The twigs bear relatively few small leaves at their tips and likewise show the spiral common to species of *Costus*.

Having passed through this peculiar part of the forest, where only the naked stems of *Tapeinochilus* form the undergrowth and their broad projecting branches and heavy inflorescences rise above our heads, we arrive beyond the shade of the forest-margin. In front of us lies the marsh with small groups of trees on the somewhat drier places, but for the largest part covered with tall-growing plants. The forest-margin there is principally composed of low trees inclining toward the marsh (*Fig. 10, n*), such as *Premna integrifolia* L., *Kleinhovia hospita* L., and a couple of species of *Ficus* (nos. 916, 951). The *waroe* (*Hibiscus tiliaceus* L. var. *abutiloides* Hochr.; *Fig. 10, p*) is found here in large numbers, and the same is true for *Artocarpus*, as far as the drier places in the marsh are concerned.

The transition from the bare forest-bottom to the marsh-flora is introduced by grasses and terrestrial ferns, such as *Helminthostachys zeylanica* Hook. f. (*Fig. 10, l*). Usually there follows a strip of the previously mentioned entangled fern-species, *Phegopteris prolifera* Kuhn (trop. O. W.; *Fig. 10, q*). It forms a mass a meter high, which appears more or less to follow the water-line in dry periods. This plant possesses very long wiry stems but a very compact habit. It is propagated almost exclusively by gemmae; everywhere one may find a

number of young plantlets on the fronds, but only after a long search did I find a specimen with spores.

The chief border-plant of the adjacent marsh is *Scleria elata* Thw. (*Fig. 10, r;* no. 836; trop. As.), growing about 2.5 m. high and recognized by the sharply 3-angled stem and similarly shaped leaf-sheaths. However, the deeper places are overgrown with higher reeds. Unfortunately, in the absence of specimens, their identity is uncertain, but it is perhaps not too daring to suggest that we have here a mixture of *Phragmites* and *Saccharum* (*Fig. 10, s*). Where the water is still deeper, all higher growth is lacking.

The climbers and epiphytes here occur chiefly in the thinner forest-margin and in this terrain mostly on the side toward the marsh. Epiphytes having particularly, at least as far as we know, only very distant connection with the earth, occur in undiminished numbers. Similarly I have already noted above that the bird's nest fern, *Asplenium nidus* L. (trop. O. W.), is unusually common in the forest itself, but toward the margin of the marsh we found also *Antrophyum parvulum* Bl. (Java, Penang, Phil.), *A. semicostatum* Bl. (S. E. As. —Polyn.), *Nephrolepis radicans* Kuhn (trop. As.), a pretty fern with limp drooping pinnately incised fronds, and a number of species of *Pleopeltis*, such as *P. nigrescens* Carr. (S. E. As.—Polyn.) and the more or less nest-like *P. punctulata* Bedd. (trop. O. W.). Here also the myrmecophilous *P. sinuosa* Bedd. (Arch.) climbs upward along the trunk and branches of the host with the aid of anchoring roots. The thick rhizomes are hollow and thickly beset with bright brown scales. The wall is thin, the interior being hollow even to the conical outgrowths which bear the fronds. A species of small brown ant lives in these passages. Again we meet *Ophioglossum pendulum* L., particularly over the damp places, and in drier places *Vittaria* species, as *V. zosterifolia* Willd. (Madag.—Polyn.) and *V. squamosipes* v.A.v.R.* *Hymenolepis spicata* Pr. (Madag.—Polyn.) is very common. I found only one species of *Lycopodium*, *L. falciforme* v.A.v.R. (N. Guin., N. Pomm.).

Species of *Hoya* also are very common on the branches of trees on the sunny margin of the marsh, and in the higher branches one may see *Myrmecodia* (no. 1095) and *Hydnophytum* (*H. radicans* Becc., end., and *H. commune* Val.). It is hardly necessary to mention that orchids are likewise richly represented. Among others, I found here *Liparis confusa* J. J. Sm. var. *papuana* J. J. Sm., *Thrixspermum validum* J. J. Sm., *Bulbophyllum tollenoniferum* J. J. Sm., *Appendicula reflexa* Bl. var. *neo-pommeranica* Schlecht., *Pomatocalyx incurvum* J. J. Sm., *Acriopsis javanica* Rw., *Robiquetia gracilistipes* J. J. Sm., *Dendrobium toadjanum* J. J. Sm., and *D. subfalcatum* J. J. Sm. Here *Elatostema pedunculatum* Forst. (Madag.—Polyn.) is also epiphytic.

Just as the epiphytes are found in the margin of the marsh, climbers also occur in this habitat. In the gnarled branches of a *waroe* (*Hibiscus*), *Faradaya splendida* F. v. Muell. climbs high; elsewhere we find *Abrus pulchellus* Wall. (no. 832; E. Afr.—N. Guin.) and *Ichnocarpus volubilis* Merr. (trop. As.— Austr.). The number of Araceae is not nearly so large as on drier terrain, *Pothos Albertisii* Engl. (end.) being almost the only representative here. The red-fruited *Piper* (nos. 834, 1098) too prefers the darker part of the forest. Another liana fairly common here is *Combretum trifoliatum* Vent. Finally, one of the very common plants covering trunks is a species of *Dischidia*, apparently *D. imbricata* Schum. (*D. Collyris* Wall.) (nos. 969, 1080; Arch.) of which the orbicular small leaves on both sides of the stem lie pressed flat against

the host-trunk. The young parts of this plant, also those which are protected against direct light, are rose-colored. The leaves are somewhat convex and cover, as in other species of the genus, a number of fine rootlets which grow from the nodes and extend their branches out into the humus collected beneath the leaf.

On the bivouac side of the river, marshy stretches lie between the stream and the foothills, the vegetation of which is very similar to that of the Meervlakte (cf. *Fig. 9*). It is best developed in the shore-area lying southeast of the camp. Nevertheless, the flora here is already unmistakably under the influence of the hills and, particularly on the margin, typical hill-plants extend into this area. Also on the side of the river a natural levee is formed, mostly but a few meters broad. Between this levee and the hills, the terrain is almost impassable and in many places occupied by a deep marsh. The undergrowth consists of a large number of *Pandanus* plants of all sizes, large grassy reed-complexes mingled with Cyperaceae, Zingiberaceae, and robust terrestrial ferns. About halfway between the camp and the river-bend to the southeast of it, a small tributary empties (*Fig. 9, 2*), so that I could continue my observations both on the land side and on the Idenburg River side. South of this terrain lies the pretty saddle mountain (1050 m.) of which we had a view from the bivouac. We saw this mountain later from Doormantop as a small hill in the distance.

On the bank of a small creek (*Fig. 9, l*) at the mouth of a brook I found a beautiful and richly flowering specimen of *Dillenia calothyrsa* Diels*, the branches loaded with large yellow flowers. Also here, in the shade of a white-flowering *Syzygium megalanthelium* Diels*, a number of specimens of *Jussiaea* (no. 885) stood on the muddy shore, with a small community of *Fimbristylis* (aff. *F. Merrillii* Pulle, no. 891). Everywhere inland the ground-cover consists of species of *Mapania* (nos. 1015, 1016, 1042, 1199), the shrubs *Desmodium umbellatum* DC. (no. 1020) and *Kibara* (aff. *moluccana* Perk.) (no. 1230), and an undergrowth of small herbs, particularly the acanthaceous *Rungia* (no. 782) and *Hygrophila* (no. 1021), and also the commelinaceous *Floscopa scandens* Lindl. (no. 1038; trop. As.—Austr.). Here I found also a couple of staminate plants of *Baccaurea dasystachya* F. v. Muell. (no. 1007), of which elsewhere (*Fig. 9, 6*) I observed a number of pistillate trees. I also saw here the large pods of *Entada scandens* Benth. (no. 1154) hanging from the highest branches of the trees. In a small marsh in the neighborhood were many *Pandanus* plants, and along the drier edges a number of tree-ferns (*Alsophila scaberulipes* v.A.v.R.*). The marsh itself was covered with a growth of Zingiberaceae (nos. 1062, 1106), mixed with the beautiful yellow-flowered *Curculigo scapigera* Hall. f. (end., no. 1047).

From the land side I examined this stretch of the bank at two places on the river. Once with a proa I went up the small tributary which forms the drainage of a large fen between the river and the hills (*Fig. 9, 2*). The mouth is 15 to 20 m. broad, and the banks consist of stiff and slippery clay; it seemed to me that here also natural levees are formed, only proportionately smaller than near the large river. Also the vegetation is more or less the same but less sharply divided into zones. After having gone around some curves, one comes unexpectedly to a low reed-field on the right bank. After that, first in clusters, later as a unit, the primary forest rises high, while the background is closed by the saddle-mountain. An obstruction of dead trees (*Fig. 9, a-a*), which have made some of the smaller rivers of New Guinea so notorious, prevented me

from going further with the proa, and the terrain appeared to be almost impossible for walking. On the left is a low *waroe* (*Hibiscus*) forest full of aerial roots and low overhanging branches and trunks above the muddy ground, the latter covered only with fallen leaves. The small levee here is not broader than one or two meters and indeed in many spots is entirely lacking. On the bank is a small community of *Fimbristylis* (no. 891) and near by one of *Pouzolzia hirta* Hassk. (S. E. As.—Austr.). The tree-flora of the levee is poor and consists almost exclusively of *Hibiscus tiliaceus* L. var. *abutiloides* Hochr., *Kleinhovia hospita* L., *Vitex glabrata* R. Br., and *Barringtonia* (no. 1006). As far as undergrowth occurs, this is composed of species of *Cyperus* (nos. 805, 808), *Helminthostachys zeylanica* Hook. f., *Diplazium esculentum* Sw., and, just as in the Meervlakte, also on the margin of the marsh, *Phegopteris prolifera* Kuhn, with which is the usual growth of *Scleria elata* Thw. in wetter places.

The other place where I examined this terrain from the river lay by the first bend southeast of Prauwen-bivak (*Fig. 9, 3*). Here, on the first gravel-bank along the shore, I saw a rugged specimen of *waroe* (*Hibiscus*), but, in this much drier location, without aerial roots and with more upright trunk and branches. Beyond, the terrain is drier and the forest contains more woody giants. Enormous specimens of *Flagellaria* climb to the highest crowns, rattans hinder progress everywhere, and a rather thick undergrowth of shrubs proves that this terrain is no longer subject to periodic flooding. Among the shrubs I found *Anomopanax* (no. 1012), *Garcinia* (no. 964), and especially a number of Rubiaceae, which constantly dominate the undergrowth. There are, for instance, species of *Ixora* (no. 787), *Lasianthus chlorocarpus* K. Schum. and *Lasianthus* no. 797, *Tarenna Guelcheriana* (K. Schum.) Val. and another species of this genus (nos. 968, 1052, 1053), *Psychotria leptothyrsa* Miq. (Ceram), *Mycetia javanica* Korth. (S. E. As.), and a *Plectronia* (no. 970). A single tall *Pandanus* occurs here among the trees; I saw one with aerial roots originating at about 10 m. above the base. In addition to the above-mentioned shrubs, the undergrowth contains *Crinum asiaticum* L., an intruder from the Meervlakte. Also *Donax* (no. 900) is common here, just as at Pionier-bivak. Clinging Araceae are relatively rare; *Rhaphidophora drepanophylla* v.A.v.R*. was collected here.

On the edge of this terrain a small brook flows into the marsh (*Fig. 9, 4*). Under the light shade is a small community of three species: *Polygonum celebicum* Dans. (Borneo, Phil., Celebes, Moluccas), a *Panicum* (no. 899), and *Alternanthera sessilis* R. Br. (pantrop.; no. 901).

Another locality I examined was the land near the mouth of the Doorman River. On the right bank lies a large *gelagah* [*Saccharum*] field. Behind this the forest appears to be about the same as the Meervlakte type or rather one of the many aspects which the plain offers. Here a close growth of screw-pines [*Pandanus*] screens a marsh which is furnished with small compact groups of trees festooned with lianas. Among the screw-pines the low flora consists almost entirely of grasses and Cyperaceae. *Donax* and *Leea sambucina* Willd. (trop. O. W.) grow on the drier parts of the levee, also a few tall ferns, *Tapeinochilus*, rattans with pneumatophores, etc. *Phaseolus truxillensis* H. B. K. (S. E. As.; no. 988) is a beautiful purple-flowered liana on the river-bank.

The vegetation on the left bank offers a similar picture. I found here too a yellow-flowered *Pisonia* (nos. 980, 982) as a shrubby tree in the undergrowth. Here again *Artocarpus* is very plentiful. I commented in my diary regarding

this: one of every five trees is an *Artocarpus*. Perhaps this is a little bit overdrawn, but in any case it illustrates the frequency of this tree. I also collected here a myrmecophilous *Conocephalus* (no. 983). The number of myrmecophilous plants in New Guinea is strikingly large, and they belong to the most diverse families. Beccari, on his journey through the Archipelago, observed these interesting plants and devoted to them a beautiful work [6] wherein he described and illustrated a large number of them. Most belong to the Rubiaceae and particularly to the genera *Myrmecodia* and *Hydnophytum* (here nos. 924, 986, 1107), each of which has a large number of species. But the Verbenaceae, the palms (some rattans), the Euphorbiaceae, the Myristicaceae, the Asclepiadaceae, the Monimiaceae, and even the ferns contain myrmecophilous representatives. We add to this list the above-mentioned *Conocephalus* (Moraceae), the gesneriaceous *Cyrtandra* (nos. 804, 810), *Semecarpus myrmecophilus* described by Lauterbach,[7] and lastly a *Canarium* species native in the Moluccas and New Guinea (*C. acutifolium* Merr.[8]). A very high liana here was *Phylacium bracteosum* Benn. (no. 993; Malacca to Phil. and New Guinea).

Close to Prauwen-bivak on the northwest side, the hilly land slopes gently toward the river. Toward the marsh the vegetation does not differ essentially from that on the other side of the river, but these terrains offer so much variation that one repeatedly encounters new combinations and plant societies. So I encountered a river bank vegetation at *5* (*Fig. 9*) which was divided into some very sharp zones and which will be described briefly.

Beyond the muddy shore, here also covered with many mud-pyramids, is again the usual reed-area, in this instance about 4 m. broad. The land rises a few decimeters and immediately, mingled with the *gelagah* [*Saccharum*], are some breadfruit and *waroe* trees festooned with herbaceous climbing plants such as *Luffa cylindrica* Roem. (trop. O. W., cultiv. pantrop.). Farther in, a flat strip about 10 m. broad supports a few trees under the light shade of which is a very thin undergrowth of *Cordyline terminalis* Kunth, *Tapeinochilus*, and a few tall ferns such as *Diplazium esculentum* Sw. (trop. As.—Polyn.). The young fronds of the last are used as a very well-flavored green vegetable. With these ferns are a number of Cyperaceae (nos. 802, 830, 902, 919, 959, 1017, 1023, 1104, 1174), like the *Diplazium* 2–3 m. high. Apart from this the land is bare and, even in the dry period, still very wet; at high water-level this terrain is surely flooded. Still farther in *Cordyline* and *Tapeinochilus* are no longer found; both apparently need a combination of much dampness and considerable sunshine. In the Meervlakte also they appear to be limited to these conditions. Wherever the ground is drier and therefore the shade of the trees thicker, Cyperaceae dominate the undergrowth. Intermingled with them are a few small herbs, for instance species of *Hygrophila* (no. 1021) and *Rungia* (no. 922). In this last zone, about 5 m. broad, is the real hill forest covering the now slowly rising land. In its margin, however, various species typical of the transitional region grow. One of these is the earlier referred to *Baccaurea dasystachya* F. v. Muell., of which I found at *6* (*Fig. 9*) a number of pistillate specimens (no. 875) growing together. It is a small tree with very

[6] O. Beccari, Piante Ospitatrici, Malesia II (1884–6), pp. 7–284, t. 1–65.

[7] C. Lauterbach, Engl. Bot. Jahrb. LVI (1921), p. 366, and W. Slis, Nova Guinea XIV (1924), I, p. 99.

[8] Mentioned in my monograph of the Burseraceae of the Netherlands Indies, which will shortly appear in the "Bulletin du Jardin Botanique de Buitenzorg."

fragrant flowers hanging down from the trunk in rather long racemes. It is noteworthy that Schumann & Lauterbach in their "Flora der Deutschen Schutzgebiete in der Südsee" mentioned (p. 392) a similar habitat for this species: "auf dem zeitweise überschwemmten Vorlande am Fusse der Berge." This plant in the Buitenzorg Herbarium is represented only from Sumatra, Billiton, and New Guinea. Schumann & Lauterbach credit it also to Java. In September 1920 I found it in flower; the blossoms are tolerably large and light yellow. At the time of my return from the mountains in December it bore greenish purple spherical fruits.

In addition to the tree indicated above, the Euphorbiaceae are represented by another species of *Baccaurea* (no. 1039) and by the curious *Endospermum formicarum* Becc. (no. 1028; New Guinea, Morotai), which, as the specific name reveals, is myrmecophilous. It is a moderately tall tree with fragrant flowers. All branches have thin walls and are hollow. These cavities originated through the intervention of a species of large black ant, which, as Beccari has already observed, bored through the wall. I found this to be the case when, in the middle of 1926, I discovered (*Fig. 11*) the tree along river-banks in Morotai Island (northeast of Halmahera). The nodes of the branches are slightly constricted and are entirely or almost entirely solid. The internodes contain a very compact and light pith. The ants [9] themselves enter the branches by eating through the wall. Often they seem to select for that purpose scars of fallen leaves, since these perhaps offer somewhat less resistance, but openings may be found anywhere. Once an opening is made, the pith quickly disappears and living room [10] is available. Frequently scale-insects [11] are kept therein.

Other Euphorbiaceae in this region are a species of *Mallotus* with light yellow flowers (nos. 954, 1030) and the large-leaved *Macaranga riparia* Engl. (Key Is., N. Guin.—Polyn.; no. 1037), of which both the bast and the periphery of the pith contain a thick-flowing, dark red, sour gum. *Phaleria papuana* Warb. (end.; no. 909), with wine-red cauliflorous fruits, belongs in the category of smaller trees. A small palm, *Licuala* (no. 876) also is common here. The general picture of this forest is very attractive. As a transitional region between two very different types of vegetation the flora is interesting; and the forest is easily passable on account of the relatively sparse undergrowth. This was the place that I, after having seen fresh cassowary tracks many consecutive days, saw one of these large birds flee in front of me. Apparently they came here to drink from a small brook where naked muddy spots alternated with small patches of *Helminthostachys zeylanica* Hook. f. and *Pleopeltis aquatica* v.A.v.R.

Lianas, clinging plants, and epiphytes are well-represented here. *Flagellaria* and *Gnetum* are fairly plentiful. Sometimes *Ichnocarpus volubilis* Merr. occurs. In still other spots we find *Conocephalus* (nos. 950, 1029), *Dioscorea* (no. 1035), and *Cissus discolor* Bl. (S. E. As.; no. 1034). A *Trichosporum* (nos. 858, 884, 1051), with its beautiful fiery red flowers, gives color to the trunks to which it is attached. *Pothos quinquevenosus* v.A.v.R.* adds its yellow spadix or its fiery red fruits.

[9] On Morotai, according to the determination of Dr. W. M. Wheeler (Cambridge, U. S. A.): *Camponotus* (*Colobopsis*) *quadriceps* F. Smith.

[10] Beccari, Malesia II, p. 44, t. II.

[11] According to Dr. Wheeler, belonging to a genus related to *Coccus*.

FIG. 11. Branches of *Endospermum formicarum* Becc., with ants (*Camponotus* [*Colobopsis*] *quadriceps* F. Smith) and scale-insects (*Coccus?* sp.).

Few herbs grow here. There is a single small area with *Elatostema*, or ferns such as *Diplazium cordifolium* Bl.; on higher terrain the most important herbs are *Donax* (no. 990) and scattered specimens of *Pentaphragma macrophyllum* Oliv. (end.; nos. 784, 785, 908, 971), especially characteristic of the lower foothill regions. The latter, through its robust somewhat coarse growth and its large yellow flowers, is a striking herb (Campanulaceae). *Elatostema novoguineense* Warb. frequently occurs as a component of a small community with ferns and *Selaginella*. *Elatostema pedunculatum* Forst. is epiphytic here, but always on the lower branches or parts of the trunk; *E. frutescens* Hassk. (Java, Sumatra, N. Guin.), likewise an epiphyte, also grows here.

With the description of this terrain we now have come to that of the lower hills. The foothills to the west of Prauwen-bivak are separated from the river by the gently sloping region described and offer a great variety of aspects. Deeply carved creek-ravines and steep boulder-beds of short torrents alternate with hills strewn with large pieces of deeply fissured rock. To the northwest of the bivouac a spur of the saddle-mountain rises rather steeply. Through a singular error of the officer of the supporting military detachment, the highest summit of the spur received the name "Casuarisnest." It is thus a worthy counterpart of the "Dromedarisberg" on the south side of the mountain, of which Pulle [12] relates that he was obliged to rename it "Kameelberg," since it has not one, but two summits. With the first advance of the vanguard into the interior, the officer took a pile of leaves on the top of the hill for a cassowary's nest, in which the bird known as the mound-builder lays its eggs. At the summit, about 230 m. altitude, towards the southwest (*Fig. 9, b*) an outlook was later opened, giving a view of the Central Mountain Range which was sketched from there (see Fragment V) and surveyed. A blanket was placed here in a vertical position, which later was observed from Doorman-top and rendered Kremer good service in checking his position. At a distance of 30 km. it was distinctly visible to the naked eye, especially when the sun was low in the west.

In describing the flora of this hilly country we shall again start from the bivouac. It is not surprising that here no ruderal flora has developed. When I arrived, the bivouac was only three months old, the first landing having been May 11, 1920. Possibly a few Scrophulariaceae (nos. 864, 889) might be considered to be adventive plants. This is not necessarily true of the *Jussiaea* which was growing on the bank. For that matter conditions here are not nearly so favorable for the establishing of aliens as at Pionier-bivak. The supplies brought were less in quantity and many of these were repacked. But in addition the bivouac, with its small area and its steep slope subject to erosion, is much less favorably situated for the persistence of adventive plants. The dead wood in the bivouac was apparently an excellent habitat for fungi (nos. 817–9, 870, 879, 928–32, 998–9, 1066–8, 1087–8, 1090, 1160, 1193–5, 1219, 1234, 2091–2). I found not only *Ganoderma Cochlear* Murr. and *Polyporus rugosus* Nees, previously reported from Pionier-bivak, but also *Polystictus Lamii* Lloyd, *P. affinis* Nees & Bl., *Phaeoclavulina Zippelii* van Overeem, *Auricularia auricula Judae* Schroeter, *Fomes lamaoensis* Murr., and a bird's nest fungus (no. 2088). I also observed here *Dictyophora phalloidea* Desv. (no. 2089) in a sterile condition, and collected, on the body of a butterfly, the insect-fungus *Cordiceps Moelleri* Henn. (no. 2111) earlier described from New Guinea. For the sake

[12] A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, p. 125.

of completeness I note the collection of a few green algae (nos. 1082, 1235) from a neighboring brook, and some mosses (nos. 1070, 1204, 2095–6) from fallen tree-trunks.

The factors which control the forest in this region are naturally identical with those which prevail on the hills near Pionier-bivak. The only difference to which we shall here call attention is that of soil. At Pionier-bivak the hills consist of sedimentary rocks and their erosion products, but here the soil is derived from eruptive rocks. It is generally accepted that the mountains of New Guinea originated [13] geologically in relatively recent time. For the Central Chain this is the Tertiary (Miocene), for the mountains lying to the north, some think an even later age must be accepted.[14] All the mountains are still entirely covered with sediments which are found up to Wilhelmina-top (4750 m.). The northern chain of the Central Mountain Range appears to form an exception to this. In three places far removed from each other, the chain seems to consist of eruptive rock-formations, namely, at the source of the Rouffaer River (van Gelder),[15] in the region of Doorman-top (van Overeem Expedition), and again on a point east from there (de Wal Expedition). Because of the little knowledge which we possess regarding the flora of this gigantic island, it would be useless now to attempt to correlate the differences in the flora with differences in soil. Consequently, at present, we need not dwell longer on the ecology of this forest, which still remains a typical rain-forest many hundred meters higher up. I am, however, not claiming that local differences cannot be found. A strongly broken terrain, such as the young mountains with their deep ravines and steep inclines, naturally provides all kinds of different conditions. Slopes composed of blocks of rock, relatively flat parts with many steep walls practically without humus, damp ravines, small summits, and narrow ridges indicate some minor divisions of such a region, each of which exerts a series of distinct influences on the flora. Through these, the forest offers sufficient variation.

The previously mentioned *Vitex Hollrungii* Warb. is plentiful on the slopes of Casuarisnest. A stately palm (*Kentia*, no. 1065), rare here but very common higher up on the mountain, will be discussed in the next Fragment. Of the other moderately tall trees I indicate the white-flowered *Galearia* (no. 1190) and a few species of *Baccaurea* (nos. 1039, 1192, 1229), all cauliflorous. Somewhat smaller are *Ardisia lanceolata* Roxb. (no. 814; Malacca, Sumatra, Java, Borneo, Celebes, Phil.), with lilac flowers and dark purple fruits, *Dracaena angustifolia* Roxb. (trop. As.—N. Austr.), a couple of species of *Ixora*, *I. bivakkensis* Val.* and no. 938, with a thick red and creamy yellow inflorescence, *Goniothalamus caloneurus* Miq. (no. 957; end.), a few representatives of the genus *Garcinia* (nos. 1013, 1187, 1202), all with white or yellow flowers, *Gnetum Gnemon* L. (no. 1228; trop. Afr.—N. Guin.), *Tabernaemontana aurantiaca* Gaudich., and a species of *Gonocaryum*, the last two with rather large orange-colored fruits.

In most places the undergrowth is rich in shrubs (chiefly endemic): *Aglaia* (nos. 809, 958, 1083), *Chisocheton Lamii* Diels*, *Saurauia Lamii* Diels*, *Styrax*

[13] Miss Gibbs (Journ. Ecol. VIII, 1920, 105, note) records, on the authority of Smith Woodward, that typical marine fossils from the Miocene have been found at 4200 m.; she suspects that the uplifting took place during the Pleiocene.

[14] Moszkowski (l. c. 283) mentions fossils from the van Rees Mountains as of the late Tertiary period.

[15] Jaarboek Mijnwezen XXXIX (1910), 101.

(no. 811), *Macaranga* (no. 1189), *Symplocos Lamii* Brand*, *Tylecarpus papuanus* Engl. (end.), *Amaracarpus lanceolatus* Val.*, *Cyrtandra* (nos. 804, 810, myrmecophilous), *Morinda bracteata* Roxb., *Lasianthus chlorocarpus* K. Schum. (no. 1217), *L. chrysotrichoides* Val.* (no. 975), *Lasianthus* no. 936, *Clerodendron buruanum* Miq., *Orophea Dielsiana* (Lauterb.) Diels, *Semecarpus laxiflorus* K. Schum., *Urophyllum glomeratum* Val.* and *U. calycinum* Val.*, *Parasponia* (no. 953), *Pipturus repandus* Wedd. (Arch.), *Kibara* (no. 1230), *Antiaropsis decipiens* K. Schum. (nos. 799, 1081; end., from a systematic point of view a noteworthy moraceous plant, which is conspicuous because its inflorescences have fiery red bracts), and finally a few Leguminosae (nos. 852, 854–5, 920), also Melastomataceae such as *Otanthera Lamii* Mansf.,* with white flowers and raspberry-like fruit, and *Ochthocharis megalophylla* Mansf.*, with rose flowers. A number of other species, in motley variety, occur in the undergrowth. Separately I shall mention *Drimys oligocarpa* Schlecht. (end.), since it may be considered as a forerunner of the true mountain-flora in which we shall encounter other species of that remarkable genus of the Magnoliaceae.

Toward the river, where the earth is more level and therefore damper, there are occasional patches of *Cotylanthera tenuis* Bl. (Java, Borneo, Phil., Soemba), a pale-colored saprophytic plant of the Gentianaceae, which one frequently notes on similar terrain. On the slope the enormous number of juvenile rattan plants is striking, also those of a conifer which I cannot determine with certainty, but which is apparently *Agathis alba* Foxw. Young plants of this are scarcely distinguishable from those of *Podocarpus Blumei* Engl., which likewise occurs in New Guinea. Bird-hunters informed us, however, that extensive stands of dammar trees (which furnish the copal of commerce) are found along the banks of a tributary of the van der Willigen River, and so I think that my supposition is justified. In addition to the shrubby undergrowth many herbs occur. Amongst the most beautiful of these are *Pentaphragma macrophyllum* Oliv. and *Forrestia mollissima* Koord. (no. 952). Also striking is the small *Geophila reniformis* D. Don (pantrop.), which formed almost the only ground-cover on a small area at the foot of a hill; the plant attracted as much attention by its snow-white flowers as by its cherry-red fruits. A number of Zingiberaceae (nos. 806–7, 925, 1001, 1210) belong naturally to the robust herbs. On the summit of Casuarisnest two species (nos. 823, 1079) grew promiscuously. In damp places a couple of handsome species of *Dianella*, *D. coerulea* Sims (Phil., N. Guin., N. Austr., New Cald., Fiji) and *D. carinata* Hall. f. (end.) are common, as is also *Ophiorrhiza crispa* Lauterb. (end.). *Dianella carinata* Hall. f. is very plentiful up to near the forest-border. *Oldenlandia pubescens* Val. (end.) prefers a drier terrain. In similar places the ground is frequently covered by more or less extensive patches of *Elatostema*, *Begonia* (nos. 851, 890), *Selaginella gracilis* Moore, and *S. puberulipes* v.A.v.R.* In the last species, which does not grow very large, I several times observed that almost all the sporophylls were connate, so that leaves and sporangia alternate with each other. Terrestrial ferns in this forest are likewise unusually abundant. In damper places toward the river are small communities of *Blechnum orientale* L. (trop. As.—Polyn.). Apart from that one finds in the undergrowth *Tapeinidium pinnatum* Chr. (Arch.—Polyn.), *Diplazium cordifolium* Bl. (Afr.—Polyn.) and *D. opacifolium* v.A.v.R.*, *Lindsaya trichophylla* Copel. (end.), *Syngramma pinnata* J. Sm. (E. Arch., Austr., Polyn.) and *S. lanceolata* Diels (N. Guin., Fiji), *Blechnum Finlaysonianum* Wall. (Arch.), *Aspidium teratocarpum*

v.A.v.R.*, *Asplenium cuneatum* Lamk. (pantrop.), *Dryopteris repandula* v.A.v.R.*, and *D. cyclosora* v.A.v.R.* Among the ferns one of the most common ground-covers is the dark green *Trichomanes cupressoides* Desv. On blocks of rock on the slopes I found a couple of species of the last genus intermingled, *T. millefolium* Pr. (Sumatra, Java, Phil., N. Guin.) and *T. suffrutex* v.A.v.R.* Similar blocks, which are scattered on the north slope of Casuarisnest, are frequently entirely covered with mosses and ferns and a number of small Orchidaceae growing with them. Examples of the ferns are *Campylogramma pteridiformis* v.A.v.R. (end.) and *Lindsaya trichophylla* Copel.; the orchids belong particularly to the genus *Microstylis*, which occurs in similar habitats on many islands of the Archipelago; the species here is *M. Floscularia* J. J. Sm. Often others are noted, such as *Eurycentrum atroviride* J. J. Sm., with the leaves dark green above, and *Hetaeria oblongifolia* Bl. var. *papuana* J. J. Sm. In the humus among these blocks of stone are a few terrestrial Araceae, such as *Homalomena Peekelii* Engl. (end.) and *H. Versteegii* Engl. (end.), and in somewhat damper places *Holochlamys elliptica* v.A.v.R.* and *Schismatoglottis pomatophila* v.A.v.R.* Among the herbaceous flowering plants, the acanthaceous *Rungia* (no. 1022) and *Hemigraphis angustifolia* Hall. f. (no. 888; Arch.) appear. In addition to the already mentioned *Hetaeria*, another terrestrial orchid here is *Plocoglottis tropidiifolia* J. J. Sm. Occasionally the saprophytic burmanniaceous *Gymnosiphon affine* J. J. Sm. is noticed.

Among the clinging Araceae, which occur here in very large numbers, *Rhaphidophora drepanophylla* v.A.v.R.* and *Pothos papuanus* Becc. (end.) are plentiful. Representatives of the last genus and *Dischidia imbricata* Schum. are the most common plants covering the tree-trunks, and, particularly in specimens of small size, the leaves are frequently less than 1 cm. in diameter. Possibly these are young forms, since I observed neither flowers nor fruits on such plants. On the other hand, *Scindapsus altissimus* v.A.v.R.* is a very large plant which I found on the summit of Casuarisnest. It has a large cigar-shaped bright yellow spathe almost 50 cm. long and 6.5 cm. thick (still closed) growing aloft in the crown of a tall tree. The leaves of this plant are somewhat the shape of those of the banana, the older ones being frayed transversely in the same way.

Large lianas are always rare in the center of the forest. Of the smaller ones which do not reach the forest-roof, I collected the purple-flowered *Dissochaeta Schumannii* Cogn. (end.) and *Uvaria littoralis* Bl. (no. 1182; trop. As.), the latter with beautiful chocolate-colored flowers widely scattered along the almost leafless, thin, and flexible stem.

The epiphytic flora of the lower parts of the trunks offers little new. I again found *Nephrolepis radicans* Kuhn. Another epiphytic or somewhat clinging fern is *Trichomanes aphlebioides* Chr. (Moluccas, N. Guin.), a species with dimorphic fronds; the fertile ones are smaller and are placed close together on the rhizome, the larger sterile ones extending upward separately. Also I found here *Polypodium sclerophyllum* v.A.v.R.*

Among the epiphytes in the crowns of trees, the Orchidaceae again occupy the most important place. There are *Pomatocalyx incurvum* J. J. Sm., *Appendicula reflexa* Bl. var. *neo-pommeranica* Schl. and *A.* (aff.) *furfuracea* J. J. Sm. (no. 1178), *Dendrobium squamiferum* J. J. Sm. and *D. poneroides* Schl., *Eria oligotricha* Schl., *Ceratostylis mamberamensis* J. J. Sm., *Podochilus scalpelliformis* Bl., *P. mamberamensis* J. J. Sm., and *P. imitans* Schl., *Dendrobium Phalangillum* J. J. Sm., *Malleola palustris* J. J. Sm. & Schl., *Glomera uniflora* J. J. Sm.,

Bulbophyllum mamberamense J. J. Sm., and finally *Taeniophyllum* (no. 1085). The melastomataceous *Pogonanthera reflexa* Bl. (S. E. As., W. Arch., Phil.), with yellow flowers, is also an epiphyte. Another very plentiful epiphyte in this region is *Dimorphanthera tridens* J. J. Sm.* (no. 976), a richly flowering plant with large, broad, bell-shaped flowers of a warm red color. Like the *Glomera* and *Dianella* previously mentioned, this ericaceous species, in a certain sense, may be considered as a forerunner of the mountain-flora, since, in the main, related species are mountain-plants.

Prauwen-bivak was one of the most pleasant camps, in spite of the clouds of day and night mosquitoes. Our never sufficiently praised mosquito-room reduced the pest to a bearable minimum. Lying close to the river and a few meters above it, this bivouac provided a spacious and sunny view. Toward the southeast spread the broad river and the foothills of the Central Mountain Range (*Fig. 12*). Immediately before us lies the forest-margin of the Meer-

FIG. 12. Outlook from Prauwen-bivak to the southeast.

vlakte. Toward the north we again see the wide stream, with its slowly circling eddy full of driftwood and other vegetable-debris, and the mouth of the Doorman River in the background. Here we enjoyed our morning coffee at sunrise; here we sat together in the late afternoon to gaze at a beautiful sunset. Then silence and repose descended on the sultry plain before us, and with the fading of the daylight the strange bird *Cracticus quoyi* also ceased its calling. This call so strikingly resembles that of a far distant Papuan dog that at first we were repeatedly mistaken regarding it. At that hour also, the parakeet flocks (*Chalcopsittacus duivenbodii*) flew over toward the mountains, where later we could see them fly home after a long day on the plain. But this scene was not always peaceful. Sometimes a rain-storm from the southeast, rushing across our mosquito-proof shelter, drove us all out with our books and notes.

On such evenings, however, we could enjoy the lightning-discharges over the wide plain, which illuminated the whole neighborhood.

The commissary department also was attractive in this bivouac. Sometimes on the table appeared a large bowl filled with fish fresh from the river; then again we had real turtle soup, the thigh of a cassowary, or a fat crown-pigeon. Once while there we tried *koeskoes* (*Phalanger maculatus*), and one day the doctor and I even ventured to eat crocodile, which is not as distasteful as tradition says, and strikes a happy medium between fish and veal.

It appeared indeed as if the animal kingdom in this vicinity likewise found greater expression than elsewhere. Apart from the usual nuisances of the forest, such as mosquitoes, leeches, wasps, and ants, which one finds everywhere, we observed much more wild life than at Pionier-bivak. I have already mentioned that once I saw a full grown cassowary flee with great strides and much noise. Tracks which I measured were up to 26 cm. long and 20 cm. broad. I have mentioned too the crown-pigeons. Of the animals here, after the pigs, the *koeskoes* (*Phalanger maculatus*) are the most common. These are sluggish animals which sleep through the day and go out marauding at night. Occasionally we shot one out of a tall tree, and for a long time we kept a young one in the camp. It was practically motionless during the day and, moreover, was very vicious. Another marsupial, once caught by the zoologist in a snare, was *Parameles*, a small creature which lives on the ground and somewhat suggests a small piglet.

Of the reptiles, I have previously called attention to turtles and crocodiles, and also to the poisonous snake *Acanthophis antarcticus*. Occasionally larger snakes were brought in or observed; I myself saw one about 2.5 m. long. Frogs, numerous in this country on account of the relatively few snakes, are seen everywhere, and are particularly audible. Sometimes at night we heard a loud almost roaring or bellowing call in the forest which we attributed to one of these amphibians. The doctor once noticed a good specimen swimming in the river, which, spread out, was more than 50 cm. across. Giant forms were also found amongst the earthworms. In all characteristics they reminded one of the common earthworm, but they were up to 1 m. long and 2–3 cm. thick.

I will close these few remarks on the fauna with a brief discussion of one of the most curious phenomena in nature that I ever witnessed: the swarms of day-flies. As is well known, day-flies are the adults of neuropterous insects belonging to the family Ephemeridae. The larvae live in various stages as predators in the water, but the imago, which eats no food during its ephemeral existence, is concerned exclusively with the propagation of the race. This fact itself is sufficiently remarkable, but still more so is the simultaneous emergence of all imagoes at a definite place.

Ephemera swarm in the lower stretches of the large rivers, and repeatedly we witnessed this phenomenon occurring in little or great profusion once every two or three weeks. The Meervlakte appears to be a peculiarly favorable region for these insects: nowhere did we see such enormous swarms of them as here; and this natural phenomenon makes the greatest impression on one who sees such a swarm originate in his immediate vicinity, and the next moment is encircled by myriads of these insects. One day when I was returning from the mouth of the Doorman River in the direction of the camp, I was engaged with the coolies in gently paddling the proa. Somewhat sleepy from the fatiguing work of the forenoon in the sultry marsh, my eyes were half-closed against the

intense light reflected from the surface of the calm and smoothly gliding stream. Suddenly my attention was drawn to a day-fly fluttering up and down near the proa, a white and light yellow delicate little insect which hastily and with sudden turnings dragged its slender appendages over the water. Still without suspecting what was about to happen, I gazed languidly out over the broad calm river until all at once my interest was awakened: an ephemerid appeared close beside me, struggling to free itself from the water. Although now I tried to observe with greatest interest and every effort, I failed to follow in full detail what occurred there. At close quarters I tried to see how the insects emerged from the water, but yet at the same time my eyes were drawn to many other points, thousands of them, where the same thing was happening. A few minutes later, I looked out over the river, so quiet a moment ago; its surface was already swarming with thousands of day-flies. After a considerable time spent in close scrutiny, I succeeded in observing a day-fly twist out, free itself from the larval covering, and dart quickly away. The empty skin, as an almost invisible membrane, slowly drifted away with the stream. Within a very short time—not more than five minutes—the whole river was covered with millions of day-flies. Some flitted to and fro over the water, others rose a few meters above the surface and repeatedly fell into the proa. The males have the extremities transformed into claspers, with which they embrace the females. I observed but few pairs. Occasionally I saw two contact for a short period, but I could not determine whether this was really the act of copulation. Just as in the European species, among the thousands of males present, here only a few females appear. Both sexes have two thread-like appendages on the abdomen —in the male much longer than in the female—with which they draw two fine traces across the water. Under the last abdominal segment the female has two pear-shaped egg-sacs which are easily lost by contact. Not long, a few hours at the most, the swarm remains in full strength. At first repeatedly hundreds of individuals join it, but gradually birds come from the forest and reed-fields, as well as fish from the muddy bottom, to reap the harvest. Small bee-eaters and *spitsvoegels* fly to and fro. I observe those already wearied by the hunt and satisfied, resting on branches protruding out over the water, but nevertheless, they could not resist the temptation of throwing themselves once more into this abundance of food. A thin darker cloud of birds whirled through the thick white cloud of day-flies, and the pink jaws of the Siluridae snapped above the water repeatedly. At twelve o'clock I saw the first day-fly appear; at three they had all vanished. What has become of the remaining individuals which have not fallen victims to the birds and fishes, or which the wind has not thrown down unhospitably in the forested river-banks?

Later I went downstream again with the small motor-boat, likewise about noon. I chanced upon another even larger swarm. From afar, the river appeared as if it were buried under a snowfall of day-flies. We traveled for more than an hour through the uninterrupted thick swarm, which thus was at least 15 km. long. A moderate estimate (10 individuals per cu. m.) gives 120 million day-flies.

In Europe a similar phenomenon is known. Brehm [16] gives us a striking description of this, prepared by Réaumur, who observed it on the Marne during an evening in 1738. In all details the description agrees with my observations.

[16] Brehm, Tierleben, Insekten, 3rd edition (1892), p. 548, and 4th ed. (1915), p. 55.

I have already said a few words concerning the Papuans who dwell in the Meervlakte, and I shall not venture further into the anthropological and ethnographical domain. However, I shall not close this Fragment without a comment on a striking journey made by bird-hunters coming overland from Hollandia on Humboldt Bay. They knew how to reach Prauwen-bivak and apparently had learned of our presence in the Meervlakte and counted on our support. Otherwise they probably would not have risked this undertaking. The band was led by two Chinese, the rest being sturdy Papuans from the north coast. In all there were 21. Perhaps I should not have mentioned this incident were it not for the fact that the band, according to their leaders, had lived entirely on the produce of the land. In a ten weeks' march overland they reached the upper course of the Idenburg River. At first they had been able to obtain some provisions from the kampongs through which they passed, but very soon they had to live entirely on the country itself. While each day an organized group searched for food, the others hunted birds of paradise and crown-pigeons. Thus they travelled for more than 70 days, living on food obtained by hunting and fishing. On a point downstream from the great gap of the Idenburg River they made four proas, and with these dropped downstream, reaching Prauwen-bivak after seven days. There, under our protection, they remained some time to hunt.

It is frequently said that the tropical primeval forest, and particularly that of New Guinea, furnishes little food—too small an amount to supply the needs of travellers. This band provided the clearest evidence that this is not the case, at least for the lowland. It will not be easy for pampered Europeans to follow their example, although Moszkowski [17] says that he lived exclusively on the country for nearly two months in the Meervlakte. In low regions there are always plenty of pigs, pigeons, and cassowaries. The river contains an abundance of excellent fish; the Dyaks frequently secured 10–20 kg. in an hour. And the Meervlakte and other areas with fresh-water marshes supply as much sago as one could wish for. Furthermore, as side-dishes for meals, there are to be considered turtle and monitor-lizard eggs, young palm-buds and young fern-leaves (*Diplazium esculentum*). The growing tips of *Pandanus* and rattans can likewise be eaten, breadfruit provides a vegetable, while roasted *Gnetum* seeds, fruits of species of *Syzygium*, and some species of rattan may serve as tidbits. In case of need, other sources of food are: all kinds of marsupials, such as tree-kangaroos and phalangers, the duck-bill, smaller birds and larger ones such as the jungle fowl, the kalongs (fruit-bats), crocodiles, and snakes, not to mention other reptiles and amphibians. Thus at low altitudes one need not fear starvation. But in the mountains conditions change quickly. The most important sago, forming the chief article of food, disappears. The breadfruit tree soon follows. Once high in the mountains, one finds scarcely more than pigs and cassowaries, *Pandanus*, palms, some small birds, and marsupials. Even the natives never go into the mountains without taking food with them, since it is realized that existence on what the country supplies would be precarious. Wollaston relates a touching illustration of this.[18] It concerns a case in which about ten Papuans, mostly women and children, perished from hunger during a journey into the mountains, because they had not carried a sufficient supply of food with them.

[17] Cf. footnote 3 in this Fragment.
[18] Geogr. Journ. XLIII (1914), p. 264.

V. The north slope of the Central Mountain Range [1, 2]

During the month (August 15–September 18, 1920) that I spent at Prauwen-bivak, the Casuarisnest was developed as a location-point for the future inland expedition, as the Central Mountain Range was our objective both from the standpoint of biological field work and in accordance with our commission. It has already been mentioned in Fragment IV that an outlook on this hill was opened toward the southwest. Here a greater part of the route to be followed is to be seen and sketched (*Fig. 13*).

It was September 18, 1920, that Lieut. Drost and I set out upon our inland journey with the weekly transport. As mentioned earlier, I was accompanied by two native helpers, Ajoeb, mantri of the 's Lands Plantentuin at Buitenzorg, and Siman, assistant mantri in the Herbarium.

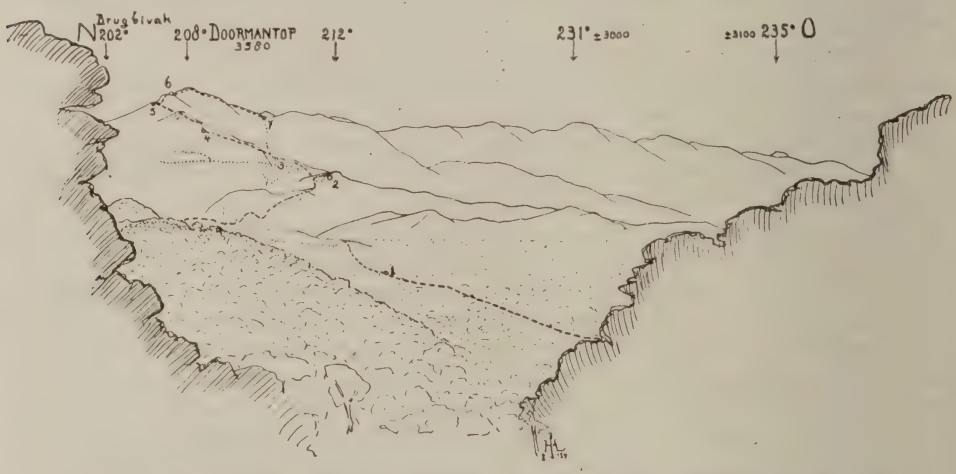

Fig. 13. Sketch of the Central Mountain Range, seen from Casuarisnest. — — — — = visible part of the route followed; ..... = part of the route not visible; 1 = Woud-bivak; 2 = Bivak Goenoeng Boetak; 3 = First Parkieten-bivak; 4 = Beek-bivak; 5 = Uitzicht-bivak; 6 = Radio-bivak; 7 = Mos-bivak.

At the time of our departure, the patrol of Capt. van Arkel was still operating in the advance-terrain. He had reached Doormantop just two days before. On September 6th, the leader, Capt. Kremer, and the geologist followed their trail with a strong transport; the ethnographer, the doctor, and the zoologist remained at Prauwen-bivak.

After having passed the open clearing we descend again to the plain (cf. Fragment I, Map B). The trail, which originally ran across the marshes, was later diverted more toward the foot of the hill, because it appeared that the ground-condition did not permit a regular transport to travel by the old route.

[1] Natuurk. Tijdschr. Nederl.-Ind. **88**: 252–324.. 1928.

[2] The Indian Committee for Scientific Research, which organized and equipped the Scientific Expedition to Central New Guinea 1920–1922, made the publication of this series of richly illustrated articles possible by a grant from the Royal Natural Philosophical Society. The editors and the writer express their appreciation for this support, to the Committee named.

After one transport had passed over, the superficial layer of roots was so destroyed that, even in the dry period, one sank so far in the marsh that it was impossible to make any progress. But even our new trail nearer the foothills leads us over long stretches which are transformed into deep muddy pools. Soon the trail turns away from the foot of the hill and lies over entirely level terrain. At first the path is easy. The brooks coming from the hills have cut into the terrain, thus forming terraces; the banks are perpendicular, and between the broad loops lie entirely flat areas where the growth is thin and the vegetation reminds one strongly of the forest-margin of the Meervlakte. There are only a few woody giants; the remaining timber is slender and small, only few trees having a diameter of three to four decimeters. In the undergrowth practically all shrubs are lacking, but locally there are solid stands of *Elatostema* or *Selaginella*, and indeed of many different kinds of ferns. In other places where the forest-floor is almost bare, *Vrydagzynea elongata* Bl. occurs. In short, we find here so many points of agreement with the vegetation of the forest-margin of the Meervlakte that we may well suppose that this terrain is inundated in the rainy season, at least occasionally.

At nine-thirty, after having forded a couple of smaller brooks, we reach a larger stream that meanders so much that we have to cross it six or seven times at short intervals. It is a beautiful broad brook, with a bed of hard sand and gravel. The water is clear and occupies about 10 m. of the 25 m. wide floodbed, the deepest channel being almost a meter deep, so that we wade through up to the hips. Through the narrow opening made by the brook in the forest, we see a small part of the heavily wooded hills to the southeast. Slowly and noiselessly the dark water flows by us, while here and there a heavy tree-trunk lies half under the water; I note in the branches of such a tree the half-destroyed carcass of an old hornbill which has died a natural death.

After a short rest at this place we proceed. Now for a part of the way we follow the bank, high and steep on the outer curves, flat and broad on the inner curves and here sometimes with small *gelagah* [*Saccharum*] fields. In such patches we almost always note the Job's tears grass (*Coix Lacryma Jobi* L.), the hard fruits of which are used by the Papuans as beads. Sometimes we proceed a few hundred meters across the bed of the brook, here divided into streamlets, and continue our journey again over another terrace-bank. A characteristic plant of such stream-beds is a small *Ficus* (no. 1285), a widely branched shrub with a flat top, the narrow-lanceolate leaves all spreading horizontally 0.5–2 m. above the water. Perhaps the top of these shrubs is about equivalent to the highest water-level. Some specimens grow on the bank and the branches of these develop chiefly on the side toward the stream, spreading far over the water; most, however, are erect on gravel-banks or in the shallow water. The branches stretch out at a tolerably sharp angle in all directions, but particularly downstream; thus the plant may reach a diameter of three to four meters. In 1926, in the lowlands of Morotai, I found again a similar growth in river-beds; possibly it was even the same species, for entire gravel-banks were covered with a thick shrubby pure stand of *Ficus*. The habit is particularly characteristic of plants which live in similar habitats. Beccari [3] first called attention to this peculiarity and designated the phenomenon as stenophylly (a condition characterized by narrow leaves). He men-

[3] O. Beccari, Nelle Foreste di Borneo, 2nd edition (1921) p. 324, 424, t. LVII.

tioned its occurrence in *Fagraea*, *Garcinia*, *Psychotria*, *Eugenia*,[4] *Syzygium*, *Erycibe*, *Saurauia*, *Tetranthera* (l. c. t. LVII), *Milletia*, and *Pinanga*. He thinks that the particular form of the leaves and the development of slender flexible branchlets is an adaptation to constant air-currents over the river-beds and in ravines subject to periodic flooding. He mentions *Salix babylonica* L. as an example of this in Europe. Beccari named air-currents as the cause of the adaptation in the first place; but I think Ridley [5] is closer to the truth in placing more emphasis on the fact that such plants have to offer resistance to the dragging force of the torrents. Rightly he compared the leaf-form and the flexibility of the twigs with plants living in flowing water (e.g. species of *Potamogeton*), with floating leaves arranged in large measure to resist the effect of the current. In addition to this species of *Ficus*, we add to Beccari's list *Homonoia riparia* Lour. (S. E. As., W. Arch.) which sends [6] out vertical twigs from its somewhat horizontally radiating branches.

Apart from the *Ficus*, the bank was practically bare except for the fairly common *Hemigraphis reptans* T. Anders. (1243–4), a small acanthaceous plant with relatively large whitish flowers.

Intsia amboinensis Thouars is very plentiful on the forested terraces. *Gonocaryum*, *Gnetum Gnemon* L., and *Tabernaemontana aurantiaca* Gaudich. are undergrowth shrubs. Also abundant is a small palm with a short trunk (nos. 965, 1181), previously encountered in the hilly terrain at Prauwen-bivak. It was immediately noticeable because of the few broadly lanceolate leaves being gray-white beneath, the distal half being longitudinally slit into two lobes.

After we pass this region, the trail becomes considerably worse. Although the ground looks rather dry and passable, the carriers have destroyed the path entirely and made it a broad track of slimy brownish mud which constantly becomes broader, since everywhere the drier outer margin will hold. Nevertheless, there is no way of avoiding a stretch of 10 meters where we sink almost to our knees in the soft mass, and thus we slog along two hours through an uninterrupted series of sloughs until about 11:30 A. M., when we reach Moeras-bivak (Woud-bivak), a dreary collection of frame huts on swampy muddy ground. After a bath of problematical value and moderate satisfaction, it is midday, the first of 80 such midday stops, which are utilized in general with talking, writing, and smoking; tea is served, and after the twilight has fallen the noon meal is repeated. Curiously enough we can sleep here without mosquito nets, this being also true of the intermediate bivouacs in the van Rees Mountains. We have no explanation of this phenomenon of the total absence of mosquitoes at night. Lack of standing water surely is not the cause.

The following day the trail as a whole is better. Slowly we approach drier ground intersected by many clear brooks: we again draw near the foot of the hills. Here are extensive patches covered with a very low-growing *Begonia*, *B. bipinnatifida* J. J. Sm. (end., no. 1257), a plant hardly 1 dm. tall, with very dark green, repeatedly and finely incised leaves and pink-white flowers. Else-

[4] Endert (Midden-Oost-Borneo Expeditie 1925, Ind. Comité v. Wetensch. Onderzoekingen 1927, p. 254, fig. 100) mentions a stenophyllous species of this genus on boulder-banks. He also names a *Ficus*, *F. glomerata* Roxb. (p. 253, fig. 99), to which species, however, my New Guinean collection does not appear to belong.

[5] H. Ridley, Trans. Linn. Soc. II. Bot. III (1888–1894), p. 270 (1893).

[6] Phil. Jour. Sci. I (1906), p. 682, pl. XLII; cf. also J. G. B. Beumeé, Een tropische wilg, De Tropische Natuur XIII (1924), 43, pl. 2.

where another species of this genus grows (no. 1256) and the dull color of the forest is broken occasionally by the flower-clusters of *Clerodendron buruanum* Miq. After two hours of marching we reach the foot of the low hill which we had observed from Casuarisnest, lying as a low projection in the vast sea of level primary forest (cf. *Fig. 13*). Before we ascend we hear the roar of the Doorman River on the far side. There the incline is steep, for the river has eroded the hill. Immediately after passing the slope we have to ford a muddy brook, after which follows a small stretch of level forest, next a steep point of land with scanty vegetation, and finally a deep clear tributary, the water of which is breast-high. We arrive at a great bare boulder-strewn bank covered only in the higher parts with *gelagah* [*Saccharum*] and *Coix Lacryma Jobi* L. It is a beautiful point. The river-bed is some hundred meters broad here; the water runs swiftly in the channel between the broad boulder-strewn banks. The larger islets in the channel are covered with high trees and shrubs and are fringed with reeds. Enormous tree-trunks are stranded on the gravel-banks, having been brought down by stream-freshets. Entirely stripped of bark, they now lie bleaching in the sun and thus offer a favorite sleeping-place for large monitor-lizards. Here I saw one about 7 dm. long, with serrated crests on the back. All these trees lie with the root-system, or what is left of it, pointing upstream.

In the background the mountain-slopes rise steeply; clouds envelop the higher parts. On the left bank of the river lies the long low gently rolling hilly ridge which Doorman crossed in 1914. His inland journey began on the bank opposite us. After crossing the marshes, he continued straight on toward the inland slopes, over the ridge, down again, and finally steeply upward. At about 1300 m. altitude we should find his trail and continue along it to the summit named for him. Our own route from here is obscure. We still have no evident objective toward which to proceed. However, a great landslip is a fixed point among the numerous ravines and ridges.

The Doorman River exhibits the same characters which distinguish so many New Guinean rivers. Glancing at the map, one sees a number of rivers on the south side of the mountains—as many in the plains as in the mountainous country—each indicated by a narrow line. On the other hand, very broad ones are shown at the foot of the hills, sometimes extending over rather great distances. The fact that the rivers form deep valleys in the soft mud of the alluvial plain as well as in the mountain-country, but not in the gravel-formation at the foot of the slopes, seems to me to be due to the relatively recent age of this range. In the older mountains the rivers have already broadened their valleys. In the mountains also the fall of the river is not great, the more or less broad terraces attesting to the deposition of finely divided materials, this being true also in the valleys. Here, however, we find narrow, deep, and very sheer ravines, characteristic of young mountain-ranges. On account of the gradient, the stream flows very rapidly, and in this phase large quantities of coarse material are immediately deposited at the end of a declivity, where the fall suddenly lessens. The speed of the current here is still too great for the deposition of silt, but as soon as the end of the gravel bank is reached the muddy plain begins and, in spite of its lessened current, the river once more carves its bed deep into the soft earth. The Doorman River in its course likewise shows these three phases. According to Doorman's report, its stretch from here to the mouth on the Idenburg River is similar even over a great distance.

The doctor, who came part-way up the river from Prauwen-bivak, verified this. Later we could see from Doormantop that the river, from the place where it leaves the hills and extends far to the north, repeatedly branches and develops a number of channels. From Doorman's report,[7] it appears that he found deep marshes on the left bank, alternating with terraces almost without undergrowth and traversed by many small brooks. I cannot share the supposition of some members of the expedition. On the strength of the difference in size between the torrent-bed of the river, almost 400 m. broad at this place, and its narrow mouth (about 40 m.) where it joins the Idenburg, they thought that water must have been lost by flowing laterally into the marsh. Those who know the terrain will presently understand that this is not probable, for on the basis of a rough estimate of the flowage capacity, it will be seen that between the point of departure from the hills and the mouth on the Idenburg River no water can be lost. At low water-level the mouth is very deep. In spite of the great clearness of the water, one cannot see the bottom. With a primitive plumb made with the aid of fishing lines, I measured the depth; it appeared to be between 5 and 6 m. I estimated the rapidity of the current at 10–15 cm. per second. These figures give a volume of $0.15 \times 40 \times 5$ cu. m. = 30 cu. m. Later, at a similar water-level, I estimated the volume at Brug-bivak (240 m. alt.), entirely uninfluenced by the previous calculation, at $0.75 \times 35 \times 1$ cu. m. = 26 cu. m. Both values agree reasonably well, the difference coming within the margin of error. One of the causes for the hypothesis of lateral drainage is without doubt the fact that the cooler water of the Doorman River disappears almost immediately under the warmer water of the Idenburg River. As a result, the water of the tributary does not show clearly or can only be seen over a narrow strip.

After we have crossed the broad boulder-strewn bank and waded across one of the arms of the river, we enter a level area. The hills again recede and the river forms a number of terraces separated from each other by steep banks about 1 m. high. On account of their flatness, their hard gravelly earth, and their resulting scanty vegetation, they are easily passed. At this point Kremer-bivak was established by the first reconnaissance party, and was used by the downward transport as an intermediate camp, since it was two days' journey from Brug-bivak to Prauwen-bivak.

Under the light forest covering these terraces, whole fields of tall light green *Selaginella* form a beautiful undergrowth. To the right of us rushes the magnificent river, with its clear water undulating downward in a long frothing sequence. Shortly before we reach the second transient camp, the trail leads us under the crown of a solitary *Ficus* on the banks of a brook. The branches of this tree are festooned with a richly flowering specimen of a beautiful *Mucuna* (no. 1360) with large vermilion-orange flowers. A few hundred meters farther lies Aalscholver-bivak (Cormorant camp) on the last terrace below the point where the river leaves the steep hills. In the late afternoon, after having dined, we sit looking out over the river (*Fig. 14*), where the birds, from which the camp derives its name, are incessantly busy. They are entirely black and make the very same impression as the corresponding Dutch species. Repeatedly we see them sit on the water, float down with the stream, the head directed upstream and constantly looking around. Then suddenly they disappear under the water and after a time come up to fly immediately, skimming

[7] J. W. Langeler & L. A. C. M. Doorman, De Aarde en haar Volken (1918), 186.

close above the water, the head somewhat low. Then the same game begins again. In the calm of twilight the large hornbills fly over in pairs with a creaking noise, and here the cockatoos may be seen at play in the trees where they sleep. At night a short but heavy rain falls; the next morning the river is turbid and somewhat swollen. At six-thirty we are already on our way. It is a short day's march over the hills to Brug-bivak. Here presently a better route is found. Originally the river-course was followed as closely as possible, although great difficulties were experienced on account of the unusually steep slopes. Later, the trail was projected over the practically level upper parts of the hills. At our departure we still follow a transition to the latter stage, for

FIG. 14. Doorman River at Aalscholver-bivak, looking downstream.

the trail many times crosses small ravines of manifestly very short and steep torrents, again evidence of the youthful age of this mountain-range. If one had not everywhere found basic eruptive rock-formations, one would be inclined to believe that these hills are an uplifted coral reef, so flat are their upper surfaces. Later, from the mountain-top, we could observe this particularly well.

The forest is dense here. An unusually large quantity of moss, growing on the ground and on the lower parts of tree-trunks, attracts attention, the altitude being about 350 m. With respect to this moss-flora, a singular phenomenon is that, in the lower mountain-region at about 800 m., it is found exclusively on broad level plateaus between ravines, whereas at higher altitudes the exposed ridges particularly show the heaviest growth. In the latter instance the moss-vegetation has developed much more heavily than in the first. I fail to find a

satisfactory explanation for this phenomenon. In the forest on the south side of the Central Mountain Range at 1000 m. altitude, Pulle [8] mentions two types of vegetation: (1) tall trees with many ferns but few mosses and scanty undergrowth; (2) typical mossy forest with a very dense growth of moss covering the ground and the trunks and branches of the trees, as well as the undergrowth of many shrubs. The first type, according to Pulle, is on limestone, the second on sandstone; he says nothing about the topography of the terrain. While this explanation does not apply here because of the lack of sedimentary rock-formations, it seems to me that the topography is of decisive influence, both in the lower and in the higher mountain-forest.

After a steep descent we reach the graceful suspension bridge, over which we cross the river, where, on a small terrace, Brug-bivak is built some meters above the water-level. Immediately behind the camp the hills rise steeply. In the vicinity we see the high walls of a deeply cut ravine, where a beautiful mountain-stream, 30 to 35 m. wide, either flows smoothly against the slippery rocks, or hastens in waves along the banks strewn with large boulders, or finally, swiftly and silently flows along the small narrow terraces. We are here 16 km. distant in a straight line from Prauwen-bivak, and at an altitude of 240 m. (cf. Map B, Fragment I). I spent a full week in this locality on the banks of the roaring mountain-stream, which previously perhaps no human being other than the primitive Papuan had ever seen. It was the last opportunity, for a long time, to take advantage of the warm sunny lowland, before we commenced the cold and wretched period in the next camp, Goenoeng Boetak.

The slope of this ravine is heavily forested. From the camp one can see the white trunks of Leguminosae, with the branches frequently densely beset with Loranthaceae. *Artocarpus* is still found here. On the plateau of the left bank, as in so many places in this territory, the undergrowth is unusually rich in ferns: *Diplazium cordifolium* Bl., *D. Huttonii* Chr. (Arch.), *Dennstaedtia erythrorhachis* Diels (Phil., Celebes, N. Guin.), *Dictyopteris heterosora* Bedd. (Malacca), *Tapeinidium pinnatum* Chr. (Arch.—Polyn.), *Syngramma quinata* Carr. (Arch.—Polyn.), *Trichomanes millefolium* Pr. (S. As.—Polyn.), and *T. suffrutex* v.A.v.R.*, the last two with very dark green foliage. *Elatostema*, which elsewhere colors such large patches of ground light green, is here, as regards the number of individuals, only slightly represented. In addition to some terrestrial members, such as *E. Weinlandii* K. Schum. (end.), *E. Lamii* Hub. Winkl.*, and *E. frutescens* Hassk. (Java, Sumatra), I found a couple of climbing species and also the epiphytic tuber-bearing *E. Pellionianum* Gaudich. (E. Arch.). On the bank of a brook again I found *Microstylis Floscularia* J. J. Sm., growing by preference on mossy stones. Here too are a few species of *Ophiorrhiza: O. rivularis* Val.*, *O. doormanniensis* Val.*, and *O. torricellensis* Laut. (end.). Here grow the first specimens of the genus *Argostemma*, which is particularly well-represented in mountain-regions. These are small herbs with relatively large snow-white flowers. The undergrowth of shrubs is not exceptionally dense, but among the smaller forms the number of species is fairly large. *Cyrtandra* (no. 1345) and *Saurauia submodesta* Diels (no. 1346) are very plentiful. Among the smaller trees is the purple-flowered melastomataceous *Allomorpha parviflora* Mansf.* Among the hygrophilous epiphytes in the forest are the common *Asplenium cuneatum* Lamk. and *Medinilla Teysmanni* Miq. (Celebes, Phil., N. Guin.), with pale cream-colored flowers.

[8] Maatsch. ter Bevord. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 68 (1913), p. 34.

A long relatively broad stretch on the right bank of the river, a little upstream from the camp, gave me a good picture of the flora of beach-terraces. The stenophyllous *Ficus* is scattered everywhere, growing in the water amongst naked boulders inundated at high-water. Somewhat rare, but nowhere entirely absent, is a graceful tree-fern, *Alsophila glauca* J. Sm. (trop. As.), a robust plant attaining a height of 10 m., with a full crown and a trunk 25 cm. in diameter (measured with the old leaf-bases). Just as along the river-banks near Pionier-bivak, the forest-margins here also in a few places are adorned with the flaming red-purple inflorescences of *Schuurmansia*. For that matter, *Leea gracilis* Lauterb.* and some species of *Ficus* (nos. 1264, 1338) are common plants of the forest-margin. Here too the dark green frond of *Ophioglossum pendulum* L. hangs down from the tree-trunks over the water.

On the terraces themselves—which are arranged one above the other with an average difference in height of 1 m.—is the very large tree *Pometia pinnata* Forst. (Phil., Molucc.—Polyn.), which, as is frequently the case in this species, bears characteristic witches' brooms, these falling on the ground with the mature leaves, making positive identification possible. This species is discussed by Magnus [9] as an example of "unbegrenztem Wachstum in einer Knospenvariation." A large number of the trees here are beset with Loranthaceae, the brittle stems of which, running along those of the host, everywhere send their haustoria into the nourishing wood. One of these is *Loranthus Lamii* Krause* with dark red flowers.

The undergrowth of the forest is rather dense but never troublesome. In addition to a species of *Breynia* (no. 1250), there is an abundance of common robust terrestrial ferns, such as *Diplazium polypodioides* Bk. (1.5 m. tall; S. E. As.—Austr.), *Nephrolepis hirsutula* Pr. (2 m. tall; pantrop.), and *Odontosoria decipiens* Chr. (3 m. tall; end.), which form dense thickets under which the ground is usually almost bare. Elsewhere are smaller species, such as *Trichomanes aphlebioides* Chr. (Molucc.—N. Guin.), which attracts attention on account of the dimorphism of its sterile and fertile fronds. Where the undergrowth is thinner, one finds the usual covering of *Elatostema* and *Selaginella*, the former represented here by *E. Weinlandii* K. Schum., *E. novoguineense* Warb., *E. minutiflorum* Hub. Winkl.*, the latter by *S. gracilis* Moore and *S. subtrisulcata* v.A.v.R. *Begonia* also is locally common; in one spot I found *B. bipinnatifida* J. J. Sm. (no. 1362) again, at another locality were other species (nos. 1369, 1390). In the forest on the banks I found, now partly suspended in the crown of *Phaleria papuana* Warb. (no. 1359), the same *Mucuna* (no. 1360) already observed at Aalscholver-bivak, forming, in the branches of the supporting tree, a small bower from the roof of which clusters of large bright brick-red-orange flowers hung down. Also I found here the first *Nepenthes*, apparently *N. maxima* Nees, as a forerunner of a genus which extends to the highest mountain-summits. One sees representatives of the mountain-flora, e. g. *Argostemma* and the epiphytic *Vaccinium tiariforme* J. J. Sm.*, more in evidence here than in the hilly terrain at Prauwen-bivak. In addition to the plants just named, one notes in the forest certain climbers, *Tetrastigma Lauterbachianum* Gilg (end., sensu ampl.), *Acalypha Hellwigii* Warb. (nos. 1381—2; end.), and the graceful *Lygodium Versteegii* Chr. (Phil., N. Guin.). Of the hygrophytic epiphytes, *Asplenium scandens* J. Sm. (E. Arch.—Polyn.), *Elatostema Pellionia-*

[9] W. Magnus, Blätter mit unbegrenztem Wachstum in einer Knospenvariation von Pometia pinnata Forst.—Ann. Jard. Bot. Buitenz., Suppl. III, 2 (1910), p. 807.

num Gaudich. and *Medinilla Teysmanni* Miq. may be named, in addition to a number of species of *Pleopeltis*. Among the fungi growing on decaying wood, I mention *Polystictus incisus* Lloyd (Phil.), *P. Blumei* Lév., *P. xanthopus* Fr., and *Hexagonia tenuis* Hook. Here I found a *Cordiceps* (no. 1375) on a spider. Leaf-mosses (nos. 1268, 1270), liverworts (nos. 1300, 1304—5, 1400, 1404), and algae (nos. 1297, 1306, 1348) were collected for the sake of completeness.

In this forest I observed a peculiar pile of leaves at the base of a tree, it being about 1 meter square and 3 dm. high. On one side was an opening, the entrance to a passage about 75 cm. long. It looked very fresh, and the natives thought it was the work of wild pigs, prepared as a shelter for the night for their young.

The finest spots in this splendid ravine are the sunny boulder-strewn banks with their beautiful vegetation. In the vicinity of the bivouac, three of these are easily reached, and, notwithstanding their similarities, each has its own character. The most southerly one lies between the swift river and a steep hill. In the background a beautiful small tree, *Ficus* (no. 1380) shades a number of small pools. A patch of richly flowering *Begonia* (no. 1335) grows against the steep slope, down which the water continually trickles. In a small more level spot are a couple of species of *Impatiens* (nos. 1239, 1287). Both are robust plants more than 1 m. tall, with very large flowers about 6 cm. diameter, in one species brick-red, in the other a beautiful warm orange color. The terraces described above begin on the north side of this bank. The transition to forest is formed by a strip of tall-growing *gelagah* [*Saccharum*] and entangling ferns.

A second boulder-strewn bank lies immediately north of the bivouac. Here the river seethes against a smooth rock wall. The stenophyllous *Ficus* forms a cover close to the water; two species (nos. 1285, 1380) grow promiscuously. *Nephrolepis hirsutula* Pr. is plentiful higher up among the boulders. Wherever the ground rises, the vegetation is richer in species and denser. Grasses (nos. 1275, 1282, 1372–4, 1377, 1379, 1398) grow high amongst the rocks. There are a few Labiatae (nos. 1255, 1387), a couple of Acanthaceae, the usual *Hemigraphis reptans* T. Anders. (nos. 1243–4) and a *Lepidagathis* (no. 1262), and also one of the Scrophulariaceae (no. 1290). Taller shrubs and small trees are mingled with the vegetation, for example, *Oldenlandia Auricularia* F. v. Muell. (trop. As.—Austr.), *Breynia* (no. 1367), and *Leea gracilis* Lauterb.* Here occurs *Glochidion philippicum* Rob. (no. 1251; Arch.), striking on account of the singular fruits, with bright orange seeds, scattered along the outstretched branches. *Semecarpus laxiflorus* K. Schum., the more or less climbing rubiaceous *Mussaenda cylindrocarpa* Burck var. *leptosepala* Val.*, and *Morinda umbellata* L. (trop. As.—Austr.) var. *papuana* Val. occur closer to the slope. Against the damp slope *Begonia* (no. 1245) and *Impatiens* (no. 1389) attract attention because of their color. In the middle of the boulder-strewn bank, among low shrubs and tall grasses, a beautiful *Ixora* (no. 1249) blooms with an enormous profusion of flowers. This locality is unusually rich and colorful. The branches of a vigorous *Ficus* are literally covered with epiphytic ferns and Orchidaceae. Of the ferns I mention *Nephrolepis radicans* Kuhn, *Pleopeltis heraclea* v.A.v.R. (Arch.), *P. commutata* v.A.v.R. (Arch.), *P. accedens* Moore (Arch.—Polyn.), *Hymenolepis spicata* Pr. (Madag.—Polyn.), *Trichomanes humile* Forst. (Arch.—Polyn.), *Humata vestita* Moore (Arch.), *Arthropteris dolichopoda* v.A.v.R.*, *Antrophyum parvulum* Bl. (Arch.); and among the Orchidaceae (nos. 1260–1, 1265–6, 1298, 1307, 1315, 1347) *Podochilus imitans* Schlecht.,

Phreatia pisifera J. J. Sm., *Oberonia diura* Schlecht., *Bulbophyllum concolor* J. J. Sm., *B. nigrilabium* Schlecht., *B. aristilabre* J. J. Sm., *B. cochleoides* J. J. Sm., *B. serratulifolium* J. J. Sm., *Appendicula oxysepala* J. J. Sm., *A. Chalmersiana* F. v. Muell., *Dendrobium erectifolium* J. J. Sm., and *Coelogyne Beccarii* Rchb. f. In the grassland, among the trees giving only local shade, is the robust *Blumea sylvatica* DC. (no. 1294; Java, Phil.) and a *Rubus* (no. 1293) scrambling over the ferns. Two beautiful terrestrial orchids grow more in the shade: a white-flowered *Spathoglottis* (nos. 1277, 1395) and *Macodes Sanderiana* Rolfe, the latter having velvety leaves dark green above and dirty violet beneath, with salmon-colored nerves. This *Macodes*, like a few other terrestrial orchids (nos. 1303, 1385) such as *Cystorchis* (no. 1314), grows nearly in the closed forest. A strip of *Cordyline terminalis* Kunth forms the transition between the boulder-strewn bank and the hill-forest. Between the slope and the river, one finds a ground-cover community of terrestrial ferns and species of *Elatostema*. Among the latter, *E. Weinlandii* K. Schum. is dominant. This species, with *Selaginella subtrisulcata* v.A.v.R., forms an extensive vegetation on the shore-terrace along the boulder-strewn banks.

The third boulder-strewn bank lies on the other side of the river. Here the pattern is entirely different. Between the bank and the steep rocky slope lies a series of rather deep hemmed-in pools which were formed by the action of torrents. They are connected and show little decline in level, being fed by water filtering through under the boulders; they end in a deep bay draining into the river between huge boulders. The vegetation on the outside of the bank, along which the river rushes in a lengthy acceleration, consists of a thin stand of *gelagah* [*Saccharum*], in which are lodged scattering pieces of white-bleached driftwood. Areas never or only exceptionally flooded are covered with an assemblage of low grasses and herbs; higher up are the shrubs already mentioned above. In addition to the always present *Ficus*, there is a noteworthy *Boerlagiodendron* (no. 1319), which I found later on the return journey along brooks in the hills below Brug-bivak. It is a small shrub-like araliaceous plant with deeply incised palmate leaves. The most remarkable part of the plant is the inflorescence. Each of the rays of the umbel bears three secondary axes, the middle and shortest one with sterile flowers, the longer lateral ones with fertile flowers. The sterile flowers develop rapidly maturing false fruits. These false fruits are fleshy and translucent and resemble the fertile fruits, which later develop from the perfect flowers. Beccari [10] reports that, in one species of this genus, fertilization and distribution of the plant is fostered by birds, which by the beating of their wings when eating the sterile fruits scatter the pollen of the higher-placed fertile flowers and thereby accomplish their fertilization. I have not been able to verify these observations. However, I noted other phases and jotted down the following:

First phase: young inflorescence entirely green and surrounded by green bracts.

Second phase: the lateral inflorescences with perfect flowers still surrounded by bracts extend above the sterile cluster, the flower-buds being bright rose-orange in color.

Third phase: the buds of the fertile flowers are evident. They are every-

[10] O. Beccari, Malesia I (1877), p. 194.—See also J. G. Boerlage, Ann. du Jard. Bot. Buitenz. VI (1887), p. 101, 112, pl. XIII–XV, and H. Harms in Engler & Prantl, Nat. Pfl. Fam. III (1898), p. 8, 31, 32.

where darker rose-orange than the sterile ones and also show darker longitudinal stripes; the sterile flowers begin to form the globose, smooth, and dark red "fruits."

Fourth phase: the "sterile fruits" approach maturity in pairs with the development of wrinkles and minute warts on the surface; they are now dark purple-red; the fertile flowers are open.

Fifth phase: all pseudo-fruits are wrinkled and ripe, outside very dark purple, the flesh yellow; the fertilization of the perfect flowers has taken place in this phase, and already the small dark red fruits are beginning to form.

Sixth phase: the pseudo-fruits have fallen or have been eaten; the fruits of the perfect flowers are ripe; they remain, however, smooth and unwrinkled; their color is red, sometimes somewhat greenish.

Material was collected of all these phases.

A small community of *Equisetum debile* Roxb. (trop. As.—Polyn.) mixed with *Kyllinga brevifolia* Rottb. (pantrop.; no. 1406) occurs close to the small pools back of the boulder-bank. The steep slope rising behind the pools is flecked with white because of the enlarged calyx-lobes of *Mussaenda*, the white undersurface of leaves of *Maoutia ambigua* Wedd. (Celebes, Molucc., N. Guin.), the white and purple flowers of *Clerodendron buruanum* Miq. var. *Versteegii* Bakh., and the white inflorescence of *Conocephalus amboinensis* Warb. (Molucc., N. Guin.). The undergrowth consists of an entangled community of the beautiful *Gleichenia Warburgii* Chr. (E. Arch.), which separates the forest and the pools by a broad association; meanwhile the shore on the side of the boulder-strewn bank is beset with the ubiquitous stenophyllous *Ficus*, which stretches its long horizontal branches some meters out over the water.

The memories which I treasure of this camp are the most agreeable of the entire expedition. Here, in these virgin surroundings with the fresh clear mountain-stream, was a veritable breathing space, as much from the point of view of bathing as from that of drinking, in contrast with our experiences in the lowland camps. Sometimes I felt myself as one who, after a lapse of many thousands of years, once again glimpses the world and its inhabitants after the deluge. Then to his amazement he becomes conscious that he is apparently recalling his own primitive condition and can sympathize with roving prehistoric man. "*The sleeper awakes*"; the modern man finds himself again in the primary forest, but notwithstanding his present-day conveniences and the influences of his culture, he finds it again as he left it: as something that has remained lovely and almost indispensable to him.

The mornings are spent rambling in the vicinity. At noon I label the collection. The only inconvenience which I experience is caused by a large stinging fly, which easily bores through my puttees. A bath, frequently the second of the day, follows the work. Afterwards, toward twilight, I sit with the camp-commander, a European sergeant, on the bench of rough timber on the shore, the sergeant telling me numerous Atjeh stories, sounding a bit like good old Amsterdam tales, as we witness the fall of evening, the swift rise of darker shadows over the high walls of the ravine. After darkness is complete we return to reality. During the evening entries are made in the diary, records are filled in, and sometimes negatives are developed. On such evenings it is late before I seek my mattress next to the mantri's sleeping place.

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With the first transport arriving after I have come, the zoologist appears, in a downpour of rain, and covered with leeches which have to be removed even from the eyes and mouth with tweezers. After a day of rest, our journey together begins on September 28. The first day is easy. After we leave the ravine, we are again on one of the plains or gently sloping plateaus. A couple of times the ravines of smaller streams have to be crossed; after that we follow a broad generally rising ridge, from which we can occasionally see something of the Meervlakte through the trees. In this section is an area where the ground is covered with many large boulders; perhaps this is the foot of the great landslide which we saw from the Doorman River. For the time being the character of the forest remains the same. There is little undergrowth; large areas are almost without shrubs, the undergrowth consisting of scattered or more or less associated communities of *Elatostema*, *Selaginella*, and *Begonia*. The forest is high and, to judge from the flowers lying on the ground, it consists of practically the same species as are found in the hilly terrain near Prauwen-bivak. *Dimorphanthera tridens* J. J. Sm. (no. 976),[11] with dark red flowers, found in the neighborhood of Prauwen-bivak, appears to be very plentiful here. On a brook-bank I note *Tecomanthe dendrophila* K. Schum. (end.), already collected at Pionier-bivak; it is a bignoniaceous plant with large clusters of lilac and red bell-shaped flowers. At about 500 m. I find acorns (the only time I have found them) lying on the ground. Next is a rather deep and very wet ravine; finally we reach the brook on which Steen-bivak (425 m.) or Bivak Batoe is located somewhat lower down. Its name is derived from a couple of gigantic conglomerate blocks of several hundred cu. m. each, which apparently crashed down from above. There is a narrow and deep passage between them, which ends in a very small cave inhabited by swallows and bats. Plant-growth occurs only on the less steep upper and farther sides; the side towards the brook is perpendicular or even overhanging, thus forming a good protection and making bivouac-building for the convicts superfluous. Like practically all mountain-brooks at this altitude, this one is exceptionally pretty; the clear water flows over broad smoothly worn rocks from pool to pool. Here is a small waterfall, there the boulder-bed is broad and divided into various channels now separating, then again uniting, and meanwhile forming beautiful islets covered with vegetation. Here again is the stenophyllous *Ficus*. On a branch overhanging the water is the beautiful *Rhododendron Vonroemeri* Koord. (apparently identical with *R. Macgregoriae* F. v. Muell.), with large pale orange flowers. On the surface of a small plateau above the camp, the moss-growth is very heavy. The mossy ground is strewn with the small *Medinilla auriculata* Lauterb. (end.), with lilac flowers, and another species of the genus with white flowers (no. 1409). Both grow as epiphytes in the moss on the lower parts of tree-trunks. Here for the first time we become acquainted with a phenomenon that is very common in higher mountain-regions, in that terrestrial plants climb high in the moss along the trees: a beginning of the intermingling of ecological groups in the mountain-forest (*Fig. 15*). *Lindsaya trichophylla* Copel. (end.) is plentiful on this plateau.

The journey on the following day soon brings us out of the ravine, and via a narrow little ridge to one of the plateaus. Here it is almost level; the ground is soggy and densely covered with moss, the cover otherwise consisting of different plants usually found in damp places. Among these is a very common *Cyperus*

[11] Cf. Fragment IV.

(related to *C. alternifolius* L.), taller than a man. In addition, there are various terrestrial ferns and some terrestrial orchids. The tall white-flowered *Calanthe leucoseptrum* Schlecht. var. *bisubulifera* J. J. Sm. is a very common orchid here. A species of *Nepenthes* is exceptionally abundant; a very large number of young plants lie with their small spherical pitchers flat on the ground; the older ones climb.

On the other side of this plateau lies a steep ravine with deep canyons, of which there are so many in this part of the world. From an altitude of about 550 m. we have to descend 150 m. From afar we hear the roar of the river and, by repeated reverberation against the walls of the ravine, the sound produces the illusion of a much mightier stream than really is found. Partly by way of a precipitous brook we reach the bottom of the valley and find there a beautiful broad and deep mountain-stream, too deep and too swift for fording. Across the stream, above a waterfall about a meter high, lies a giant tree-trunk lodged between two projecting rocks, high above the present water-level. Although this slippery bridge is not particularly easy, nevertheless it offers a welcome means for crossing and we make use of it, some erect, most, however, sitting astride the log; the latter method is more practical than dignified. On the other side, located on a small level terrace, is the camp which Captain van Arkel used for some time as a supply-depot, but which is now forsaken. The chasm is again scaled on the other side; once up, the slope is less steep, and gradually we go higher. Here the forest has regained its customary appearance: tall tree-trunks, scanty undergrowth, a few lianas and climbers. The moss covering is heavier and there is a rich low flora on the more level plateaus which is not found on the slopes. At about 700 m., among other trees, I see a giant *Pandanus*, the crown alone 10 m. high, the aerial roots developed from the trunk at 25 to 30 m. above the ground.

Once in a while there is an indistinct view, now to the north, then again toward the south, as we ascend a ridge running about east and west, which will bring us toward the ridge properly named Doormantop (cf. *Fig. 13*, left of *2*). Following the gradual slope part of the way, we continue along steep slopes over all kinds of dead wood and fallen trees. Here are various specimens of *Angiopteris crinita* Chr. var. *intramarginalis* v.A.v.R.*, with the frond-segments dull white beneath. Shortly after, we cross a clear brook, on the banks of which are specimens of the large-flowered *Impatiens* common at Brug-bivak. The same species also occurs on the banks of a larger stream which we crossed earlier. We are here at about 800 m. altitude. After passing this brook we work our way along a muddy and deep trail, suddenly finding ourselves again amongst thick moss-cushions as we continue upward toward a narrow ridge. Clearly, here we are beyond the critical altitude which forms the boundary between the region of mossy plateaus and exposed mossy ridges. Here we find a superabundance of thick moss-cushions on the trunks and branches. Quickly passing along this ridge, we come to Cruciferen-bivak (840 m.). It is located on a broader part, where the forest immediately resumes its usual appearance. While waiting for the carriers, there is an opportunity to examine the surroundings. In the immediate neighborhood of the huts is a group of *Balanophora* (no. 1425), apparently *B. Oosterzeeana* Val., described from the Arfak Mountains, and nearly related to the Javanese *B. elongata* Bl. The frequently branched brown rhizomes, attached at random to the smaller roots of trees, are covered with star-shaped minute excrescences. The inflorescence

develops on these rootstocks as small spherical outgrowths which, in continued growth, burst open. The inflorescence, surrounded by light yellow bracts, projects through the gradually enlarging slit; when full-grown, the flowering heads are supported on thick yellow stalks surrounded at the base by the weakening bracts. The two sexes occur here in about equal number. It is useful to mention this, since in some known species staminate individuals are either strongly in the minority or even at times entirely lacking. Just as in many other obligate parasites (and saprophytes also), the vegetative parts are strongly reduced. The bracts, rootstock, and stem are here limited to rudiments.

In addition to *Elatostema* and many species of *Trichomanes*, specimens of *Argostemma* are collected; the last is apparently the same species, *A. nanum* Val. (no. 1415),[12] as was found at Brug-bivak. Higher up this species is replaced by another. *Cardamine africana* L. (1417, trop. Afr., As.—Japan) is the plant from which the bivouac derives its name. This species reminds one of the true mountain-flora, and during the expedition I found it as a representative of the original flora. This small white-flowered plant stands on the bank of a small watercourse under the broad arching fronds of *Angiopteris crinita* Chr. and the large stems of Zingiberaceae (nos. 1418, 1420). The brook-water has a temperature of 20° C. Representing the flora of the lower regions, the orange-flowered *Mucuna* grows here, and also the epiphytic *Rhododendron Vonroemeri* Koord. of Steen-bivak. A less agreeable reminder of these stretches are the stinging flies, which flit buzzing about, but which, like the numerous small mosquitoes, disappear at twilight. With a number of beautiful diurnal butterflies, these form the most striking part of the animal-life at this place. At night a dull roar, which apparently must be attributed to frogs, sounds through the forest.

The following morning it rains steadily, making our departure more disagreeable than it otherwise would have been. An hour after leaving, however, it begins to clear. During this time the aspect of the forest has not changed. On the inland journey we find it bleak and shivery; but even now I clearly recall what a warm and tropically luxuriant impression this forest made on us when, two months after our sojourn in the mountains, we swiftly descended from the misty woods into this typical forest of the lower hilly areas. On this day I wrote in my diary: "The path is steep. After we leave the lateral ridge, suddenly the mossy forest ends and immediately we find ourselves in an area where the vegetation, the odors, the bird-songs, and the temperature are strongly suggestive of those of the lowland. The route looks as though it were unusually easy; I had entirely forgotten such possibilities, having become so accustomed to the acrobatic turns of the trail and to the rock-formations. What appeared to us as difficult of ascent was now even more difficult, but the end was like a path through a park." Presently the trail changes again for the worse. Suddenly, perhaps at an elevation of 1000 to 1100 m., we note a short steep incline. Yet, before we have scaled it, we are surprised to observe unusually strong light in the forest, giving us the impression of approaching an established clearing or camp, or the site of a recent landslip. We have, however, ascended a narrow and steep ridge (cf. *Fig. 13*, near *2*); on the other side it is still more precipitous, and suddenly again we are in a typical mossy forest. The crooked

[12] In "Nova Guinea" XIV, 2 (1927), 249, the altitude of this specimen is not given; 3810 m. is the earlier assumed altitude of Doormantop.

gnarled trees are only 15 to 20 m. in height; dense mossy cushions cover the ground, trunks, and branches. A representative of the genus *Kentia* rises everywhere above the forest, the beautiful crowns of this palm being borne on slender trunks. The path follows the narrow ridge and is deeply covered with the soft moss. After a short time we pass a landslip extending down the south slope and permitting a tolerable outlook on the high ridges running from Doormantop towards the northeast. The summit itself is not visible from here, but the slopes of the 3820 m. peak and the vast heavily forested ravines between lie before us in all their details. The highest point is obscured by haze. Far below us we hear the sound of an invisible stream, one of the sources of the Doorman River (cf. Map B, Fragment I). Everywhere is the undulating forest which extends to the highest ridges as far as we can see.

On this ridge I find the first conifer (*Fig. 19*) other than *Agathis* and *Podocarpus*, which occur at lower altitudes. It is a *Dacrydium* (no. 2159), which seems to be rather common. Immediately a large number of species appear for the first time; a true mountain-flora in which there is place for only a few representatives of the lowland vegetation. One of these is *Dictyophora phalloidea* Desv., which I have not observed higher than this altitude (1350 m.). Everywhere the forest is lower and not so dense, on the ridge the trees being only 8 to 10 m. tall. On the north side we hear the murmur of the river far below. We pass the point where the old Doorman trail rises steeply from the ravine as a faint but unmistakable path, and also a couple of small peaks on the ridge. Again we descend. At the margin of the large long ridge sloping from Doormantop 10 km. toward the plain, we reach the bivouac located on a broader plateau. In the terminology of the expedition, the camp is known as Bivak Goenoeng Boetak, although the name (bare mountain) properly applies to Doormantop. The summit regained its rightful name, I think, from the second expedition (Kremer Expedition), and also from the natives. At this place, on the very sheer northern slope, a beautiful outlook over the Meervlakte had been opened without much difficulty. I spent about three weeks at this locality in two intervals (September 30–October 10; October 30–November 7, 1920).

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It would be difficult to imagine a more melancholy and wretched locality than that of Goenoeng Boetak-bivak. Nowhere on the rough northern slope of the Central Mountain Range is the climate so unfavorable as at this elevation. In spite of the prevailing dry season, a day here without rain is an exception; in addition it is always misty in the morning, and sometimes at noon and at night. One can see, from the meteorological data in Fragment II, that the relative humidity in the forest is almost uninterruptedly 100%, and that the air-temperature ranges between 16° and 20° C. These two factors in particular —and frequently a strong wind on the forest roof—dominate the vegetation-picture on this part of the slope. Suddenly the picture changes entirely to that which we discussed above for the lowland rain-forest. The damp atmosphere still hampers evaporation; but this factor is of varying strength and influence in different parts of the forest. The principal element, however, is the temperature, which here is 8° lower than in the plain, and clearly acts as a limiting factor. In nature, one recognizes a number of such limiting factors. One is the acid reaction of the water in high fens, another is the small quantity

of water in sandy soil, or a surplus of water in the fens (Meervlakte), or the salt content of the terrain. It may be said that all, not present in optimum proportions, and, to a certain degree, depending on their absence, act as limiting factors. Moreover, when one speaks of optimum relations, one must bear in mind that each species with respect to each factor may have a specific optimum. These ecological problems, of course, are far from simple, and we cannot do more than indicate roughly some lines embodying our ideas about the living conditions of this mountain-flora. In general, therefore, we can accept the fact that the lower temperature, as compared with that of the lowland, here acts as such a limiting factor for a large number of species. The species that can no longer compete with forms better adapted to this factor are no longer found. In this connection I wish to recall Shibata's investigations,[13] where he demonstrated for a definite species that a low temperature can hinder the development of fruit. Besides, there are a number of accompanying factors which influence the vegetation and the flora, such as:

(a) The exposure of the vegetation to the frequently strong wind, such exposure depending on the contour, the steepness of the slopes, and the width and direction of the ridges. This factor is associated in a vicious circle with that of temperature. The last favors a less dense and lower forest, and in this the vegetation is at the same time more exposed to the desiccating action of the wind, which intensifies the influence of the temperature.

(b) The steepness of the slopes and the nature of the soil as factors which determine the speed of water-drainage.

(c) The diminished air-pressure, through which both day and night stronger radiation results. The temperature extremes therefore are wider. This factor is still of little significance here, and then only for strongly exposed positions.

That these factors strongly dominate the appearance of the vegetation seems to be clear in the vicinity of this bivouac (*Fig. 16, A*), which is located on a broad less exposed swampy plateau, whereas the narrow ridge, with its precipitous slopes, is very much exposed. Where inclines ascend gradually, the transition from rain-forest to mossy forest corresponds. There is, however, a relatively low critical height, above which a strong change in the topography can bring about a sudden difference in the form of the vegetation. Just as it is improbable that the typical lowland-forest can ascend beyond a certain altitude even though the terrain be favorable, so also it is unlikely that the mountain-forest can extend to lower altitudes under these same conditions. We shall note below that the same is true in regard to the forest-limits generally, and that this proposition applies to all vegetative zones between the coast and the mountain-summits. Nevertheless, independent of the contour of the country, above an altitude of 1200 or 1300 m. one finds another unmistakable different vegetative and floral picture. Furthermore, the principal cause of this change in the appearance and the composition of the forest is the temperature. At this altitude one no longer encounters the majesty characteristic of the lowland individual trees. Other favoring factors are good soil and abundant water-supply. Yet, low temperature can be a real limiting factor impeding, in part or entirely, the favorable influence of other factors and making the ground physiologically both dry and sterile, because the low temperature prevents the plant from carrying out its vital functions as vigorously as in the lowland.

[13] K. Shibata, Biol. Centr. Bl. XXII (1902), 705.

And on the other hand, it appears that nature has supplied mountain-plants with a power of resistance in like circumstances; nevertheless, the first actual result is the disappearance of a large number of species; the second, the appearance of a number of typical mountain-plants adapted to the factors above mentioned. Something of the general appearance of the lowland-vegetation persists only in xerophytes (epiphytes) now becoming a characteristic part of the entire flora—at first scarcely noticeable, later, constantly more clear and more evident.

Before we pass on to a closer discussion of the vegetation and flora of the region of Goenoeng Boetak, to conclude these observations and for the sake of curiosity I recall the opinion of the founder of modern plant-geography, Alexander von Humboldt. In one of his excellent works [14] this traveller has compared an ideal conical mountain in the tropics, not only as to vegetation but also as regards the flora,[15] with a hemisphere of the earth. He imagined that on such a mountain one finds substantially the same plant-zones—and he portrayed it with a sharpness which could only be derived from the vegetation-zones in high European mountains—as when one journeys from the equator towards the poles. He carried this comparison so far that he even wrote: [16] "500 hexapoda" (i. e., almost 1000 m. altitude) "respondent 9° 30′ latitudinis vel 50 hexapoda fere 1° latitudinis." According to this concept the poles, in the field of plant-geography, should correspond to a mountain peak about 8800 m. high at the equator, a mountain therefore about as high as Mount Everest. Von Humboldt's opinion possessed the charm of simplicity and is easily grasped. As an original idea, it loses nothing in value, although we now know that plant-geography is much more complicated than he assumed to be the case. Besides, there is a basis of truth in the thought. In both cases we find the tropical rain-forest at the base, and also in the tropics somewhat higher up a forest poor in species, still higher the conifer forest and the "krüppel" vegetation, and finally the subalpine and the alpine (resp. arctic) flora, often with genera represented in the tropics which have their chief development in temperate regions. Finally both are crowned by a cap of perpetual snow and glaciers. However, von Humboldt saw a most important difference between the hemisphere and the tropical mountain because of the influence of seasons in the first. Because of the seasons, at greater altitudes constantly greater differences arise in the extremes of both the length and the temperature of day and night. One important point that von Humboldt did not consider is genetic plant-geography, which can better be discussed when more is known about the geological history of the earth. It needs no further demonstration that, when reviewed in detail, comparisons of a mountain-flora in the tropics and the flora of the temperate regions scarcely hold in some points. Even of the areas above the limits of the tropical forest, which are frequently spoken of as heaths, this comparison does not hold.

I have inserted these considerations here, since, in the vicinity of Goenoeng Boetak-bivak, for the first time we encounter a vegetation and flora entirely different from that which we have described for the tropical lowland. From

[14] A. von Humboldt, De Distributione geographica Plantarum secundum Coeli Temperiem et Altitudinem Montium, Prolegomena (Lutetiae Parisiorum, 1817), 86 et seq., 142 et seq.

[15] "In universum easdem tribus abundare reperies in summis montibus zonae aequinoctialis quas polum versus in zona frigida" (l. c. 143).

[16] l. c. 87.

now on we shall see the differences in a constantly increasing degree, and I have tried roughly to indicate some of these changes in a schematic representation (*Fig. 15*). I have tried to show how the xerophytic epiphytes and hygrophytes, at first separate in the mesophytic forest, gradually approach each other; further, how the hygrophytes at higher altitudes withdraw into the moss and at the same time ascend into the trees, the forest continually becoming more open, while the xerophytic epiphytes descend therein, until both groups slowly mingle, and then the hygrophytes occur in crowns of the trees and the xerophytes on the ground; finally how the last, in the absence of trees, adopt the ground as a

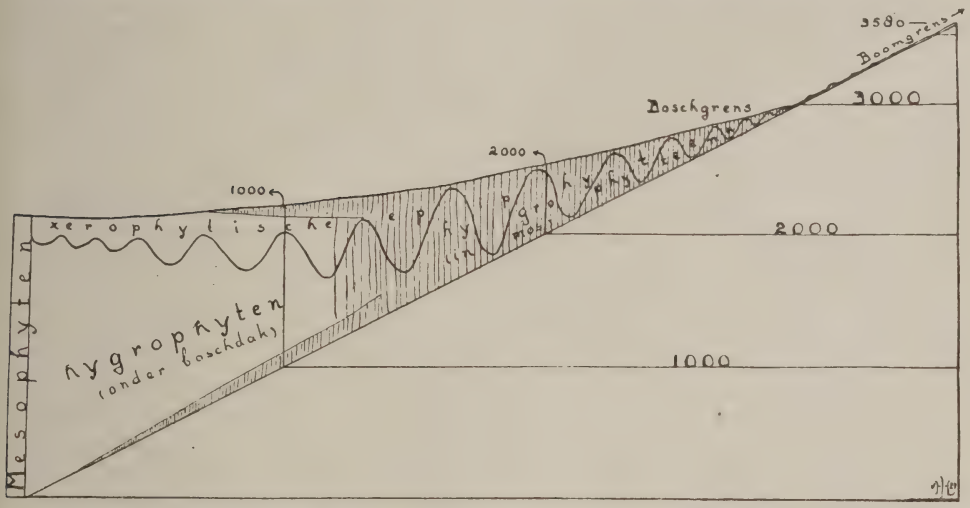

FIG. 15. Schematic representation of the vegetation at various altitudes on slowly and gradually rising terrain; on open ridges the vegetation extends lower, and in sheltered ravines higher than is indicated; the hatching is the moss-covering. Boschgrens = forest-limit; boomgrens = tree-limit; onder boschdak = under forest-roof.

habitat and mingle with typical terrestrial plants. To conclude, the associated plants tend to form separate "islands" in places where external conditions change; still higher the "islands" consist of only a few plants or even of one individual, until snow and ice make existence impossible.

We now return to the flora of this midmountain slope. One of the most striking phenomena is, as already noted, the enormous moss-covering (*Fig. 16, A, a* and *d, B*). Not only is the ground, particularly on the narrow ridges, covered with a thick layer, but also the lower parts of tree-trunks are concealed, while the branches bear isolated cushions frequently of large size. The thickness of the moss-layer is dependent on various factors, the principal ones being the quantity of light and the possibility of rapid water-drainage. On steep slopes where relatively much light penetrates and the rainfall is not retarded from sinking into the earth, the moss on the ground is several decimeters thick. On tree-trunks an important factor, next to the diameter of the trunk, is the adhesion of the moss-layer to it and the mutual cohesion of the moss-plants. Only the outermost layer of such coverings is living moss (*Fig. 16, B, 1*); the remainder (*id., 2*) consisting of a more or less decayed mass which serves exclusively to absorb water. During sustained drought—often a full 24 hours —the outer layer dries out a little so that the perpetual drip stops temporarily,

but the total capacity scarcely lessens thereby. As soon as the mists again appear, the water uptake increases and the drip begins again. On dry days after travelling through the forest one is wet to the skin, since each time one grasps a slender tree trunk for support, one is showered by the drip. Furthermore, on ridges without running water, when one is forced to bivouac this water can be utilized and in a number of instances such water was gratefully used.

This growth of mosses (nos. 1452–3, 1455–7, 1462–6, 1468, 1491, 1553–4, 1579, 1897) brings out some points worth mentioning. In the first place plants, essentially terrestrial, ascend along the trunks, so that they may be compared with pseudo-epiphytes such as are found in the humus-covered crowns of the Dutch pollard-willows. Moreover, such a moss-layer is a world in itself. In addition to the living moss-layer and the plants subsisting here on a convenient substratum (*Fig. 16, B, a, b*), a number of lower forms of animal life are also found, such as protozoans and crustaceans, the presence of the latter surely being related to the large quantity of *Utricularia* (*Fig. 16, B, c*) growing in the outer layer. As regards living conditions in such a habitat, as expected, the temperature appeared wholly to agree with that of the atmosphere. While the temperature of the air in the shade on a sunny morning was 20.5° C., I found that of the moss on the ground at 5 cm. deep 18.7°, at 20 cm. 18.4°, and at 30 cm. also 18.4°. The moss-layer on the trees showed a like temperature. One may well accept the idea that the temperature of the inside layer of this great water reservoir is very constant and about the same as the average local annual temperature. The minimum temperature, on the basis of our observations (see Fragment II, Table I), was 15.8° (6 A. M.), the maximum 20.5° (twice observed, at 11 A. M. and 11:30 A. M.), the temperature of the brook was 17.4°, and the average of 29 recordings taken between 6 A. M. and 6 P. M. was 18.3°, which agrees very well with the values found for the innermost moss-layers.

We have seen that the terrestrial flora extends partly up the tree-trunks, whereas the epiphytes increase their downward distribution. Both circumstances result from the fact that the forest is more open, and the factors of the plant-climate on the ground and in the tree-tops are much less divergent than is the case in the rain-forest. The forest-roof is not continuous, at least on steep slopes and exposed ridges, so that hygrophytes find no protection except within the moss-covering. All (Hymenophyllaceae, *Fig. 16, B, a: Utricularia, Fig. 16, B, c*) grow entirely within the limits of the moss-layer; only the spore-bearing fronds or the flowers protrude.

Now that we have given a general idea of the ecological relationships of this region, we shall observe the composition of the flora (*Fig. 16, A*) more closely. Under the higher trees is the myrtaceous *Mearnsia ramiflora* Diels (end.), which immediately attracts attention with its dark red inflorescences. *Symplocos atrata* Brand* belongs in this same category (*Fig. 16, A, b*), as does *Castanea* (or a related genus), and lastly the palm above mentioned as a *Kentia* (no. 1065; *Fig. 16, A, c*), which everywhere projects above the forest, dominating entire slopes with its profile. It is a beautiful slender tree—I measured one trunk as 22 m. tall without the crown—which strongly suggests the royal palm (*Oreodoxa regia* H. B. K.) but is less vigorous. It is doubtless a representative of the Arecineae, but I was unable with the makeshifts at my disposal to determine even the genus of this palm. Without hesitation the natives with the expedition called it *niboeng*. In the western part of the Archipelago this is the

common name for *Oncosperma filamentosa* Bl., a thorny stooling species of palm which occurs particularly back of the mangroves. In the Moluccas, however, this name is applied, usually with some modification, to a number of palms belonging to different but related genera, yet none to forms representing the same genus as this species; one can find these names (*niboeng*, *merah*, *n. ketijl*, and such) in Heyne.[17] Recently, however, Beccari, in one of Lauterbach's "Beitrage zur Flora Papuasiens," described a new *Kentia*, *K. Ledermanniana* Becc.,[18] of which the collector, Ledermann, says that this "Nipunpalme" is a "Charakterpalme des Bergwaldes." The description of the habitat (Hunsteinspitze, 1300 m.) agrees so well with that of my plant that I unhesitatingly sup-

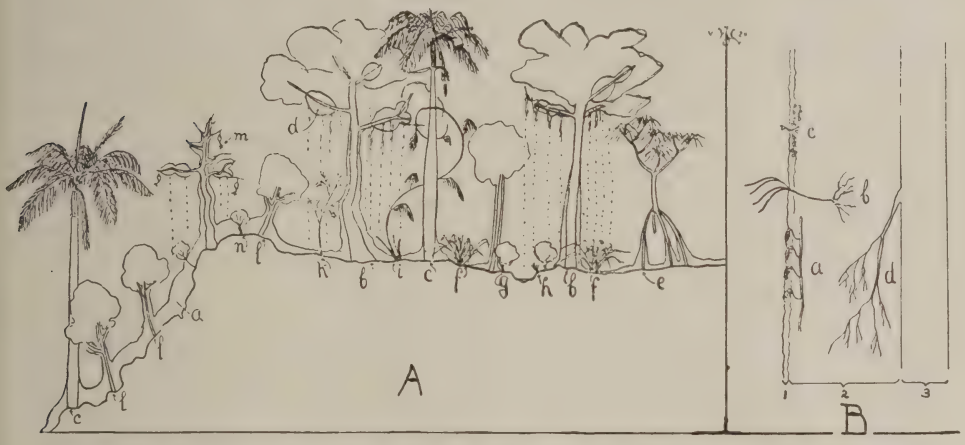

FIG. 16. A. Schematic section through the region at Goenoeng Boetak-bivak, 1420 m.; explanation of the letters in the text. B. Schematic longitudinal section through a trunk covered with moss; 1 = living moss-layer; 2 = dead moss-layer; 3 = tree-trunk; a = Hymenophyllaceae; b = *Psilotum complanatum* Sw.; c = *Utricularia* (nos. 1489, 1557); d = root of the host-trunk in the moss.

pose that my palm will be found to belong to the genus *Kentia*. I observed this species from 100 m. (Prauwen-bivak, hilly terrain) to about 1800 m. altitude, with the most pronounced frequency, however, between 1100 and 1500 m.

Under the smaller trees (*Fig. 16, A, l*), particularly in the undergrowth of the forest on the broader plateau, everywhere low species of *Pandanus* (*Fig. 16, A, e, f*) occupy considerable place. They are very common in marshy places and there most of them are stemless, and on account of their numbers they often form disagreeable hindrances in the woods. Other plants here are *Elaeocarpus Lamii* O. C. Schm.*, *Symplocos atrata* Brand,* *Xanthomyrtus bryophila* Diels,* *Phaleria Wichmanni* Val. (nos. 1507, 1889; end.), *Schizomeria Pulleana* O. C. Schm.*, *Linociera rupicola* v. Lingelsh.*, *Timonius glaberrimus* Val.*, *T. avenis* Val. (end.), and representatives of the genera *Ardisia* (no. 1563), *Actinodaphne* (no. 1504), *Macaranga* (no. 1502), *Weinmannia* (no. 1574), and further a couple of Rosaceae (no. 1506) and Theaceae (no. 1512), all trees or tree-like shrubs 4–15 m. high. On the marshy plateau back of the bivouac are *Pandanus*, a couple of species of rattan (*Fig. 16, A, i*), and, particularly characteristic, a very fine half-climbing bamboo (no. 2150) (*Fig. 16, A, k*). The last two

[17] K. Heyne, De Nuttige Planten v. Ned.-Indië, 2nd ed. (1927), 391, 396.
[18] Engler's Bot. Jahrb. 58 (1923), 442.

have stems only a few millimeters thick. The delicate green stems and leaves of the bamboo fill all the interstices in the undergrowth. Locally a couple of Zingiberaceae (nos. 1444, 1548) are common. Naturally all kinds of ferns are numerous and are present in all sizes: small dark green species of *Trichomanes* and *Hymenophyllum*, such as *T. pseudo-arbuscula* v.A.v.R.*, *T. meifolium* Bory (Masc.—Polyn.), *H. subfirmum* v.A.v.R.*, *H. ellipticosorum* v.A.v.R.*, *H. nutantifolium* v.A.v.R.*, all except *T. meifolium* being mostly concealed in the moss-cushions; furthermore, small forms such as *Pleopeltis obolophylla* v.A.v.R.* and many other species of this richly variable genus are found. Other terrestrial ferns are *Taenitis blechnoides* Sw. (trop. As.—Polyn.), *Tapeinidium stenocarpum* v.A.v.R.*, *Dryopteris rigidifolia* v.A.v.R.*, and *Cyathea perpelvigera* v.A.v.R.*, the last a small dense and compact tree-fern with a trunk about 0.5 m. high. A tree-fern of unusually large size is *Alsophila melanocaulos* v.A.v.R.*. Among the shrubs are many striking Rubiaceae, and of these *Psychotria* is especially well represented: *P. longirostra* Val.*, *P. multicostata* Val.*, and *P. multinervia* Val. (end.). Other Rubiaceae are *Amaracarpus biformis* Val.*, *Oldenlandia Schlechteri* Val. var. *acuminata* Val. (end.), and *Ophiorrhiza doormanniensis* Val.* Here also occur *Maoutia gracilis* Hub. Winkl.*, *Rapanea affinis* Mez (no. 1525; Arch., Phil.), the rutaceous *Lamiofrutex papuanus* Lauterb.*, *Ilex* (no. 1522), and *Libocedrus* (no. 2162); this place is about the lowest limit for this coniferous genus.

Among the clinging plants the Araceae, which are so strongly dominant as coverings of tree-trunks below, are practically wanting here. They are superseded by species of the genus *Freycinetia* (no. 1847), which occur in large numbers. To these may be added a few small species of *Elatostema*, such as *E. Doormannianum* Hub. Winkl.*, which ascend slender mossless trunks; also the climbing rubiaceous *Lucinaea acutifolia* Val.* In this forest there are a large number of hemi-parasites belonging to the Loranthaceae. I found three new species, *Elytranthe leucophloea* Krause*, *Loranthus gigantifolius* Krause*, and *L. cercidioides* Krause*. The last is the most striking of these, with large more or less fleshy orbicular sessile leaves, and with the small bluish waxy flowers arranged in short 3-flowered heads. Herbs, as well as climbers, are few, a result of the dense moss-covering on the ground and trunks. Here and there the white star-flowers of *Argostemma Lamii* Val.* are conspicuous; occasionally amongst the yellow-green and golden-brown moss the pink flowers of *Begonia* (nos. 1500, 1842) are on display. On the banks of small streams and watercourses the blue *Dianella carinata* Hall. f. (end.) is common.

The epiphytes in the more closed forest, at least on the lower parts of trunks, likewise are few. Here and there *Psilotum complanatum* Sw. (pantrop. and subtrop.) grows in the moss (*Fig. 16, B, b*). The *Utricularia* (nos. 1489, 1557), living in enormous numbers in the outer moss-layer, is nearly related to *U. orbiculata* Wall. (S. E. As.—N. Guin.). It is an extremely small plant, which in spite of its frequency escaped my attention for a long time. It has white sparsely branching stems, fine as cobwebs, creeping through the outer layer of moss; the orbicular small green leaves, averaging hardly 0.5 mm. in diameter, are perceptible to the naked eye, as are also the very small transparent bladders scattered along the stems. Of the millions of little plants which grow here together, I found only a few in flower. The slender inflorescence-stalk protrudes a few centimeters out of the moss and bears one or two relatively large white or pale purple flowers. The micro-fauna and -flora enticed into the

tiny bladders would be a most worthy study, and perhaps whoever investigates this material, which is preserved in alcohol, with the help of specialists, may communicate further details. In addition to protozoans and spermatozoids of mosses and ferns, probably a few Crustaceae,[19] living in the moss, may serve as food for the *Utricularia*.

Among the fungi which occur in this forest, the first to be mentioned is a horse-hair mold (no. 1490; *Marasmius*, perhaps *M. equicrinus* F. v. Muell.).[20] As on many other islands of the Archipelago, here also this fungus grows in great quantity in the undergrowth. It consists of long firm flexible threads, which are shining black and very similar to horsehairs. They extend over large interstices from branch to branch or from leaf to leaf, to which they are fastened with small flat suction-disks. Now they are entangled and branched, and again one notes long unbranched sections. It is only seldom that one observes small fruiting bodies on the threads. They are saprophytes living on dead material. Naturally there are other fungi here (nos. 1459, 1490, 1886–7, 1894–6), and also a few lichens (nos. 1580, 1898).

The open ridges, with their extensive sunny areas, show again an entirely different picture. Indeed the ligneous flora—I found among the trees the rutaceous *Terminthodia orbiculata* Markgr.*—here is about like that of the plateau. Already the forest is lower and less dense, but the terrestrial flora and the epiphytes are much more strongly developed in the more intense light. On the ground a singular small melastomataceous plant (nos. 1533, 1907; *Fig. 16, A, n*) is exceptionally common. I found only a single flowering specimen with few flowers, from which the family was easily recognizable. The small leaves of this plant are not more than a few millimeters long, narrowly spatulate, with an abrupt acuminate apex. In this terrain the Ericaceae first appear—small shrubs—among others species of *Vaccinium* (*V. igneum* J. J. Sm.*, *V. brevipedunculatum* J. J. Sm.*, *V. convallariiflorum* J. J. Sm.*, and no. 1899), *Rhododendron Pulleanum* Koord. (no. 1445), and *R. subulosum* J. J. Sm.* (no. 1906), the latter, like the rosaceous *Pygeum* (no. 1446), growing both in the moss on the ground and in that on the trunks and branches, and frequently showy because of the bright red flowers. Here are many kinds of shrubs such as *Elaeocarpus Lamii* O. C. Schm.*, *Drimys hatamensis* Becc. (end.), *Symplocos atrata* Brand*, and *S. trifurceps* Brand*; likewise species of *Levieria* (no. 1535) and *Psychotria* (*P. brevirostra* Val., end.), and the first young specimens of *Libocedrus* (no. 2162), which higher up becomes very common. The most striking thing about this vegetation, however, is the thick tangled masses of *Gleichenia*, of *Lycopodium cernuum* L. (trop. except Afr.), and of the semiscandent bamboo. *Nepenthes* is abundant here, represented by two species, the common *N. maxima* Nees (Borneo—N. Guin.) and the new *N. paniculata* Dans.* Not only mature climbing plants are everywhere but also the rosettes of young plants, with their large pitchers resting on the moss. Here and there an asclepiadaceous plant climbs; and in the shade, on a mossless spot, a small cluster of *Balanophora* plants (probably *B. Oosterzeeana* Val., no. 1537) stand together. In many places we find climbing Melastomataceae (nos. 1443, 1558) and a *Rubus* (no. 1585). *Medinilla monantha* Merr. (Phil.) var. *papuana* Mansf.* is fairly common. One representative of the Araceae, the clinging

[19] Cf. R. Menzel, Over mos bewonende Cyclopiden en Harpacticiden, enz.—Handel. Derde Ned. Ind. Natuurwetensch. Congres (Buitenzorg 1924), p. 298.

[20] Cf. Petch, Horse Hair Blights, Ann. Royal Bot. Gard. Peradenya, VI, 1 (1915), p. 43, pls.

Pothos cuspidatus v.A.v.R.*, with light green spadix and dark purple-brown spathe, occurs here. There are beautiful colors on the trunks due to the fiery red inflorescences of *Trichosporum Horsfieldii* O. Ktze. (no. 1540) and the softer red flowers of a species of *Riedelia* amongst the moss-cushions. Here are a large number of ferns, particularly among the epiphytes. However, terrestrial ferns are not lacking. The practically exclusive *Gleichenia* occupies the sunny spots, but under the trees are *Marattia rigida* v.A.v.R.*, with fronds 2 m. long and having four pairs of pinnae, and the common *Dipteris conjugata* Reinw. (trop. As.—Polyn.), the latter particularly characteristic of somewhat sunny margins. In many places *Trichomanes Roemerianum* Rst. (end.) occurs, and also the easily recognizable *Oleandra cuspidata* Bak. (end.), which immediately attracts attention, the narrow fronds festooning the stiff upright stalks which spring from the rootstock advancing under the moss on the ground and tree-trunks. The number of epiphytic ferns and Orchidaceae is almost countless, and not all the species occurring here can be mentioned. There are numerous species of *Polypodium* and *Pleopeltis*, among which are small forms such as *Polypodium pyxidiforme* v.A.v.R., *P. mesocarpum* v.A.v.R.*, *P. inconstans* v.A.v.R.*, *P. reductum* v.A.v.R.*, and *Pleopeltis remigera* Ridl. Moreover, *Scleroglossum pusillum* (Bl.) v.A.v.R. (trop. As.—Austr.) and *Lomaria acutiuscula* v.A.v.R.* grow here. Among the Orchidaceae there are a number of species with delicate flowers; the genus *Dendrobium*, so rich in forms, is important here, and in the higher mountain regions it continues to be prominent. I find here *D. monogrammoides* J. J. Sm., *D. remotisepalum* J. J. Sm., *D. convexipes* J. J. Sm., *D. sacculiferum* J. J. Sm. with beautiful dark red flowers, *D. centrale* J. J. Sm., *D. polyschistum* Schlecht., and *D. furcillatum* J. J. Sm. Of the other orchidaceous genera, I mention *Agrostophyllum fibrosum* J. J. Sm., *A. lamellatum* J. J. Sm., and *A*[*glossorhyncha*] *galanthiflora* J. J. Sm., the last showing a strong resemblance to the snowdrop (*Galanthus nivalis* L.); *Bulbophyllum navigioliferum* J. J. Sm., *B. flavicolor* J. J. Sm., *B. quadrifalciculatum* J. J. Sm., *B. muricatum* J. J. Sm. var. *sublaeve* J. J. Sm., *B. lonchophyllum* Schlecht., and *B. calceolabium* J. J. Sm.; *Glomera rhombea* J. J. Sm., *Ceratostylis muscicola* J. J. Sm., *Microtatorchis podochiloides* J. J. Sm. and *M. triloba* J. J. Sm. with orange-colored flowers; and lastly *Taeniophyllum stipulaceum* J. J. Sm. Usually a growth of liverworts (nos. 1460–1, 1883) covers bare spots on damp rock-walls.

Lastly among the epiphytes are a few noteworthy myrmecophilous plants belonging to the genera *Myrmecodia* (nos. 1517, 1536; *Fig. 16 A, m*) and *Hydnophytum* (nos. 1475, *H. vacciniifolium* Val.*, and 1516). I have amply discussed and illustrated these four species elsewhere,[21] so that I shall only indicate them here with a reference to the article in question. The two species of *Myrmecodia* are particularly abundant here. Probably they occur everywhere in the region between 300 and 1600 m., but nowhere have I seen them in such large quantities as in the neighborhood of Goenoeng Boetak-bivak. One of the most striking peculiarities of all four species is the fact that they hang from the branches of trees. Only the very young plants are sessile. As soon as the wood begins to develop in the thickened stem, the main root elongates, and one sees the mature plant hanging sometimes 0.5 m. or more from the branches. In the literature I found a similar habit mentioned only once: this in the report of the

[21] H. J. Lam, Vegetationsbilder aus dem Innern von Neu-Guinea, Myrmekophyten und Insektivoren—H. Schenck und G. Karsten, Vegetationsbilder, Reihe XV, Heft 7 (Jena 1924).

First Lorentz Expedition, where a similar species of *Myrmecodia* is mentioned as occurring on the south side of the mountains at an elevation of 2320 m.[22] Whereas *Myrmecodia* appears to prefer the more exposed habitats and therefore is most striking along steep slopes, both species of *Hydnophytum* (particularly no. 1475) remain within the closed forest, where they grow on the lower branches.

I shall omit discussion of the somber climate. It is an evident fact that this region is extremely poor in animal life. Also, the natives never seem to visit it; we saw no trace of a Papuan path at any point, and later we concluded that probably this slope never had been used as a connecting route between the interior populated mountain-valley and the Meervlakte. Possibly the native trail may be along a river, perhaps the Swart River. As to animal life, the larger birds of warm regions do not come here. For many which feed on insects, the scarcity of the latter may be one of the reasons for the absence of these birds. In any case, the typical New Guinean bird-sounds of the plain are lacking here: the scream of the cockatoos, the creaking wing-beat and the harse cry of the hornbills, the clear call of birds of paradise, and the dull somber cooing of the large pigeons. The crown-pigeons do not occur here. We are unable to establish with certainty whether the cassowary is still present. Their tracks are never seen and the call is never heard. One of the zoologist's assistants thought he had seen indication of its presence in the neighborhood of the Goenoeng Boetak-bivak, and later, as the natives of the Swart Valley had rather large quantities of cassowary feathers, one might assume that this bird still lives here. It is also possible that it, like a number of other animals and plants, does not ascend so high on this inclement slope but it may occur in the sheltered valleys in the interior, where we heard birds of paradise up to 1300 m. In the literature two instances were mentioned giving 1000 m. as the highest elevation for the occurrence of the cassowary. Ogilvie Grant [23] says that *Casuaris claudii* is still found at this altitude in southern New Guinea, and Stresemann [24] reports that the genus reaches the same height in Seran. Smaller birds are still numerous here; among these are king-fishers and species of *Dicaeum*, which eat the fruits of species of *Myrmecodia* and *Loranthus*, thus spreading the seeds. Among the largest birds regularly seen here are a few cinnamon-colored pigeons and a much-variegated parakeet, *Eos fuscata*. According to van Heurn's statement,[25] this species lives in the region between 1000 and 2000 m. altitude. Another parakeet, *Chalcopsittacus duivenbodii*, assembles in huge flocks in the Meervlakte, and in the afternoon they fly over with loud screeching. I have mentioned in a previous fragment (Fragment IV) that we observed them also at Prauwen-bivak. Lastly, the large *Microglossus aterrimus* is worthy of notice; it is a robust black parrot with heavy-framed head and beak, bare flesh-colored cheeks, and a beautiful crest.

Small marsupials are fairly plentiful. Repeatedly we could recognize the pungent odor of the opossum, *Phascogale*, and once we caught a *Dasyurus* in a snare. The mammals are represented by rats, which are very numerous. Here there are almost no mosquitoes and leeches, but frogs, like the abundant

[22] Maatsch. t. Bevorder, v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 56 (1907) p. 11.

[23] The Ibis, Suppl. 1915, p. 326; also in Report Wollaston Exped. Dutch New Guinea, 1916, 233.

[24] Novitates Zool. XXI (1914), 35.

[25] W. C. van Heurn, De Expeditie 1920—21 naar Nieuw-Guinee—Feestnummer v. d. "Club van Nederlandsche Vogelkundigen" (Sept. 1921).

FIG. 17. Panoramic sketch of the view from Goenoeng Boetak-bivak toward the north (Meervlakte); on the slopes in the foreground relatively too few *Kentia* palms are illustrated.

New Guinean ferns and orchids, are numerous, at least if one judges by the noisy concerts they favored us with each evening. It appears that most of these are tree-frogs, the sound that they produce being a quivering whistle.

How wretched and gloomy the perpetual fogs and rains are! Sometimes in the early morning and the late afternoon we had a compensating outlook (*Fig. 17*) over the wide Meervlakte. At such moments I hurried to the edge of the plateau to complete bit by bit the panorama here sketched. This was prepared at the cost of much time. During a great many mornings a low and vast cloud always covered the plain. Shortly after sunrise this cover rose and, joining the clouds, contracted, and immediately the plain was clear, the mountains still being wrapped in fog. Then we caught a glimpse of the silvery sparkling rivers, but a moment later the mists surrounded us, and the view vanished for the day.

The bivouac itself was one of the worst of the expedition, low, with a muddy floor, poorly constructed, and incompletely closed. Here we suffered more from the cold and wet than was good for us. On October 10 the Dyak transport, which was planned to continue directly to the Swart Valley, arrived unexpectedly. It was the first time that Dyaks had served as carriers on the overland journey. It was a comfort to see these continually cheerful men again after many weeks of association with convicts and soldiers. The latter were always strangers to the environment, not to mention other less agreeable characteristics. The Dyaks, however, are at home in the forest; their bearing is that of true dwellers in the wilderness, and they fit as harmoniously with the New Guinean landscape as with the New Guinean rivers. Contr. Jongejans, Dr. Bijlmer, and First Lieut. Droog came with the transport from the detachment at Radio-bivak. In the day of rest following their arrival, the Dyaks erected sacrificial offerings, eagerly sought for food in the forest, and also assisted in improving the huts, but the soldiers, who had nothing to do, remained idle. Then an egg brought from Borneo was placed on a four-pronged stick, and the mountain-spirit was appeased by the pronouncing of a long formula, in order that the entire journey should be successful. October 12 we departed; only the zoologist remained here. In Fragment I, I have already mentioned that I twice made the journey from Goenoeng Boetak-bivak to Doormantop because circumstances permitted. For the sake of continuity I shall combine the observations of both trips in the following.

* *
*

After the departure from Goenoeng Boetak-bivak, the trail lies over marshy ground covered with low *Pandanus* part-way across the broad plateau mentioned above, then upward along the bed of a small stream that plunges down at the side of the bivouac. Gradually the slope becomes steeper, finally ending in an almost perpendicular cliff a few meters high, the muddy and mossy trail bringing us to another plateau. Here the trail is level again and is deeply covered with a thick layer of moss; it has become a passage through the more than man-high vegetation of *Gleichenia* and *Dipteris conjugata* Reinw. Here, too, the terrain is marshy, but the aspect of the vegetation is not less attractive, with the globose plump moss-cushions, the many entangled ferns, the profuse semi-scandent bamboo with its slender green foliage, and everywhere a scattering of colorful melastomataceous flowers. The climbing *Medinilla* has white

flowers and orange-colored fruits, while on the ground are small Melastomataceae (nos. 1533, 1907). This vicinity is permeated with the sharp odor of *Phascogale*, and even beyond the plateau I once saw a track which I could attribute with some certainty to that of a tree-kangaroo (*Dendrolagus*).

With the attaining of this plateau we have arrived at the extensive ridge which rises from the plain to Doormantop. On the west side we now look down into the luxuriant ravine which extends from the summit (*Fig. 18*), of which we here have a view through the trees. We slowly ascend, partly following the margin through somewhat denser forest, with *Pandanus* everywhere abundant, until we stand before a rather large counter slope (*Fig. 13* at *2*). At this point we find the remains of one of Doorman's overnight camps, a dismal collection overgrown with moss, consisting of partly rotted and collapsed poles so far destroyed that it gives us little knowledge of how Doorman and his men

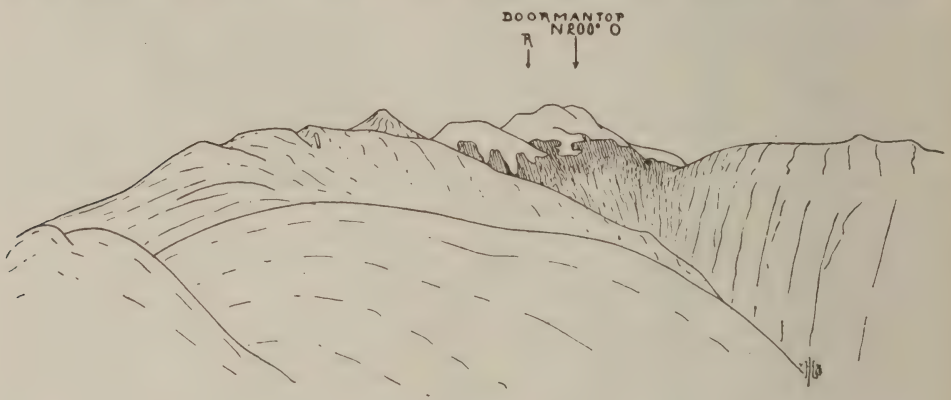

FIG. 18. Doormantop seen from a point on the ridge at 1550 m.; the irregular shaded line is the forest-limit; the white part is above the forest-limit; R = Radio-plateau.

spent the night here September 7, 1914. In the relatively low undergrowth of this denser forest lay the rusty oil-tins. The often-repeated story of the difficulties or impossibilities of finding a predecessor's camp after the lapse of a short period, because of quick tropical growth, is mostly a myth and applies only to tropical lowland and then only to open secondary growth on the terrain. In the dense rain-forest, bivouac sites, even in the lowland, are evident after some years, provided that the forest-roof is left undamaged. But if this is not the case, the practised eye can define the limits of the old camp by the locally more robust undergrowth of unmistakable type, and in the mountain-forest, where growth is certainly slower, the same holds true for even longer time. As far as the margin of the forest we see the trail blazed by Doorman, the thin trunks ending abruptly. Constantly, under the moss-covering, we find the smoothly chopped-off surface of branch-ends.

A rather steep and very muddy downward slope follows for a few hundred meters and then the terrain rises again. The ridge is now broad and the forest again high. It is the forest-type which has gradually developed from the rain-forest to a misty forest. The transition from the thinly covered narrow ridges is so striking that we, having forgotten somewhat the true rain-forest type, have difficulty at first in recognizing this as a true misty forest. However, more precise observation indicates very quickly that this 30–35 m. high forest, with

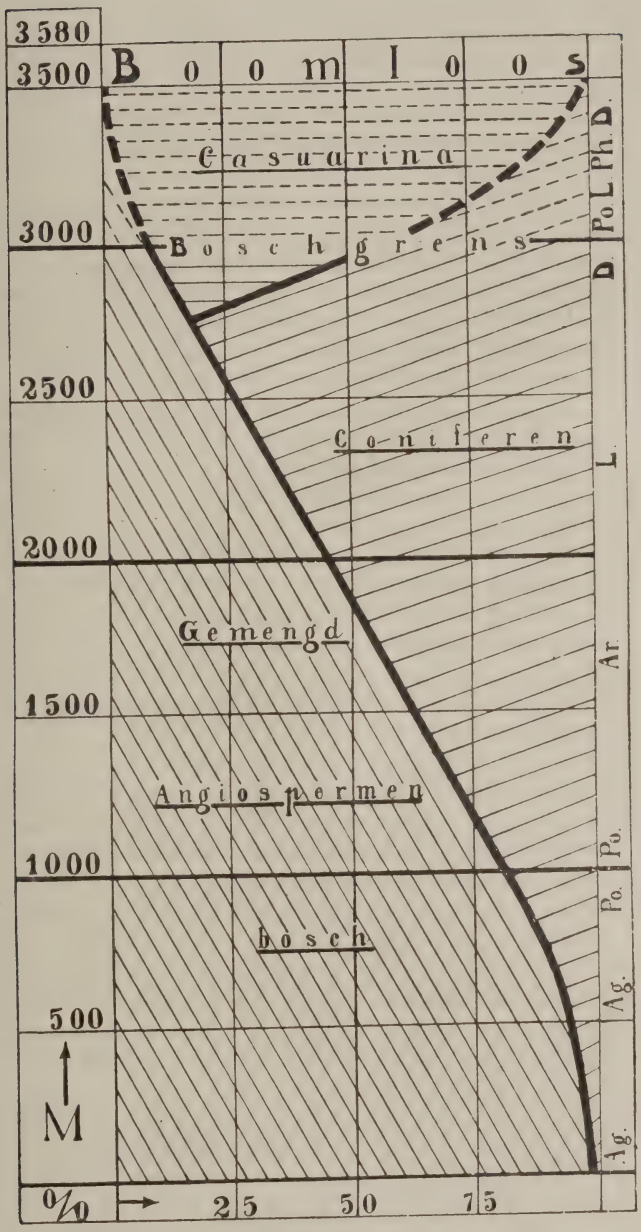

FIG. 19. Schematic representation of the percentage composition of the forest according to the number of individuals; Ag = *Agathis alba* Foxw.; Ar = *Araucaria;* D = *Dacrydium;* L = *Libocedrus;* Ph = *Phyllocladus;* Po = *Podocarpus;* boomloos = treeless; boschgrens = forest-limit; gemengd = miscellaneous.

its very slender straight trunks thickly covered with *Freycinetia*, ferns, and mosses, is indeed a true misty forest. With the gradual slope before us and with the width of the ridge, we shall not find again the subalpine forest-type characteristic of the narrow ridges at Goenoeng Boetak-bivak below an altitude of 2600 to 2700 m. The flora here indicates more clearly than the general type of the vegetation that we are in the misty forest. With almost each hundred meters' elevation one can observe distinct modifications, and already the vegetation at 1400 m. on narrow ridges and at 2700 m. on broader ridges is practically alike in general aspect, but the composition of the flora is entirely different. At every turn we see persisting species; every moment new forms appear. Thus the genus *Kentia* rapidly disappears, whereas the Coniferae increase (cf. *Fig. 19*). Everywhere one finds young plants of beautiful *Libocedrus* in the undergrowth and older specimens can frequently be recognized. At about 1700 m. I saw a *Podocarpus*, perhaps *P. costalis* Prsl. (no. 2163; Phil.). Somewhat lower, I still found fruits of *Castanea* or a related genus. Almost at the same altitude is the boundary between two species of *Argostemma*, which perhaps are vicarious. *Argostemma nanum* Val. is found in the lower hill-forest, 400–1000 m., and *A. Lamii* Val.* in the lower part of the misty forest, 1000–1700 m.; these suddenly disappear at the last elevation and are superseded by *A. montis Doormanni* Val.*, which ascends to ±2500 m. The latter—a common fact with increasing altitude—has larger or relatively larger flowers than either of the other species, and immediately appears in abundance. The species of this genus are attractive plants with large white flowers and fresh green foliage. The buds and newly opened flowers are pendent. During the development of the fruit they slowly begin to straighten, so that the fully ripe fleshy but firm fruits are erect.

At 1750 m. altitude the terrain is somewhat more level. Again there is an abundance of *Pandanus*. This genus seems to be exceptionally well-represented in New Guinea. In some regions one might even speak of *Pandanus* forests, because they predominate in the undergrowth. Pulle [26] repeatedly emphasizes this in describing the southern slope of the mountains.

In this vicinity, on a flat section close to the ridge, the First Parkieten-bivak is established. This day's march is very short, since running water is available within a quarter of an hour's walk. For a regular party consisting of a fairly large number of men, the presence of water is a *conditio sine qua non;* water from moss is sufficient only for small patrols. The next brook is at 2430 m. elevation, and the distance to that place for heavily loaded ascending carriers is too long for a single day's march. Moreover, the space available naturally plays a part when it is a question of accommodating a large number of men.

Noons it rained; this saved us trips to the running water, but kept us under cover and in the mist. Evenings we heard the calls of the common whistling frog and a deeper sound sometimes dropping a half-tone, which we likewise attributed to a frog. Also in the twilight we heard the same cicada with which we had become acquainted at a previous camp. As it grew darker, we repeatedly heard the flocks of screaming parakeets fly over on their homeward journey from the Meervlakte. They do not come much higher than this. This camp received its name from them. The Second Parkieten-bivak lies on the south slope from Doormantop, in the Dika Valley, where we observed the same phenomenon.

[26] Maatsch. t. Bevorder. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 68 (1913), 34.

On a moonless night, in the complete darkness, I saw luminous spots everywhere in the forest. It is a singular sensation to see great phosphorescent places which seem so level and so tangible, whereas the following morning the forest-floor is observed to be so irregular and uneven as well as covered with great quantities of debris. It is difficult to describe this beautiful and fantastic light. Probably it was produced by the mycelia of fungi.

In the course of the night the rain stopped. The second day's march in this section carried us back toward the ridge. Steeper parts alternated with more level places and the forest-type remained almost the same. Some places were very mossy, others much less so; the causes of these differences were not clear to me. Gradually, however, the vegetation took on the facies of the mountain-forest. Long untidy strands of moss were everywhere pendulous from trunks and branches. Incessantly the water dripped from the wet moss and, although the sun appeared, nevertheless the continuous drip in such a forest made a disconsolate impression.

At about 1900 m. altitude I saw the first specimen of the giant *Myrmecodia* (no. 1804) which occurred in such enormous numbers above the forest-limits. Here its huge tubers stood upright on an almost horizontal branch of a tall tree. Also in this vicinity I saw a couple of beautiful epiphytic species of *Dendrobium*, one with orange and yellow (no. 1820), the other with pretty purple flowers (no. 1834); the latter strongly recalled the Javanese *D. Hasseltii* Lindl. Another orchid found here is *Aglossorhyncha biflora* J. J. Sm.

About an hour after our departure we stood at the base of a very sheer slope. Here for the first time we actually became acquainted with what the geologist, who also knew the terrain on the southern slope of the mountains, called a most wretched trail even for New Guinea. One had to take high steps leading from one trunk or root concealed under the moss to another. Brushing against and sliding along moss-cushions filled with water-like wet sponges soon resulted in our being soaked to the skin. The terrain was full of unexpected dangers: rotten small trunks thickly covered with moss and apparently sound, but snapping off at the slightest touch; deep crevices and holes among sharp rocks under a blanketing layer of moss. At few places on the entire slope did I see as much moss as here. It was a golden carpet covering everything as snow covers the Alps. Halfway up, at about 2100 m. elevation, we had an outlook on the Meervlakte; through the branches we saw the silvery sparkle of the river, and for the first time we saw the hill behind which was Prauwen-bivak: the 1050 m. peak sloping toward the west into a series of lower peaks, among them the Casuarisnest.

Above, on the incline, the trail was somewhat better. Slippery slanting tree-trunks without lateral branches lying over deep holes with a chaos of plant-debris, the bottoms invisible, were the most disagreeable spots. After marching three and one-half hours we reached Beek-bivak (cf. Map B, Fragment I) at an altitude of 2430 m. On my second journey I stayed four days at this camp collecting in the vicinity.

I never have seen such an extraordinary wealth of ferns, both species and individuals, crowded together as here. Schlechter [27] rightly testified of New Guinea: "Es gibt wohl wenig Gebiete auf der Erde in welchen die Farne eine derartige Entwicklung erfahren haben, wie in Neu-Guinea und wohl nirgends treffen wir eine solche Fülle von Arten an, als dort." Schumann & Lauter-

[27] Engler's Bot. Jahrb. XLIX (1913), 1.

bach [28] in 1901 enumerated about 250 species; in 1921, according to Brause,[29] the number had increased to 509 (of which not less than 351 were endemic), and one can accept the fact that the species at present known are far more than 600. The total number of fern-species in New Guinea is difficult to estimate, but might certainly be placed at more than 1000. In 1917, Copeland recorded [30] 697 species of ferns for Borneo, which was, he thought about 60% of the number actually growing there. Borneo is much better known than New Guinea.

Immediately there is a great diversity to be found on the ground. In addition to the always present species of *Trichomanes*, such as *T. pallidum* Bl. (S. E. As.—Polyn.), with fronds silvery gray on the lower surface, and *T. meifolium* Bory (Mascarenes, Arch.—Polyn.), one finds *Tapeinidium obtusatum* v.A.v.R.* and the small tree-fern *Cyathea perpelvigera* v.A.v.R.*, here with a trunk 2.5 m. long. The most noteworthy of the terrestrial ferns at this altitude, however, is *Gleichenia ornamentalis* Rst. (end.) var. *lanuginosa* v.A.v.R.* The rootstocks of this plant creep forward at a depth of some decimeters under the thick network of roots of trees and shrubs, and I obtained a few small pieces only with much difficulty. From these rootstocks the brittle shining dark brown or almost black rhachises grow at regular intervals; they are erect, less than a centimeter thick, and up to 3.5 m. long, bearing at their apices the graceful multi-dichotomously branched fronds.

There are also a number of climbing and semi-scandent species of ferns. Close behind the hut, the protruding root-system of a fallen forest-giant was covered with light green fern-vegetation consisting of two species, which, with long flexible stems, had grown together; both have very fine pale green foliage: *Gleichenia pseudoscandens* v.A.v.R.* and *Paesia Lamiana* v.A.v.R.* Trunks of trees, their thin foliage permitting the transmission of an abundance of light in sunny weather, are thickly covered with clinging ferns. *Oleandra Whitmeei* Bak. (Celebes, Phil., N. Guin., Samoa) is unusually common; everywhere the long narrow fronds of this species protrude beyond the tangle of other ferns and mosses (nos. 1931, 1954–8, 1980, 1982, 1993–4), and at first glance whole trunks seem to be covered with only this species. A typical plant of the same habitat is *Dryopteris pseudoparasitica* v.A.v.R.*, the rootstock of which grows forward along the host-trunk, dying away behind as quickly as it grows forward. This phenomenon is very common in ferns but seldom so strongly pronounced as here. Among the epiphytes again are species of *Polypodium*, namely *P. gracillimum* Copel. (Arch., Phil.), *P. Yoderi* Copel. (Phil., N. Guin.), *P. verrucosum* v.A.v.R. (end.), and *P. pyxidiforme* v.A.v.R. (end.). The smallest forms are found in the genus *Pleopeltis*, such as *P. remigera* Ridl. (end.) and *P. linearis* Moore (trop. As., Afr., Polyn.). Epiphytic also are representatives of the genera *Lindsaya*, *Hymenophyllum*, and *Asplenium*.

I began the description of the flora of this territory with the ferns, since they dominate the vegetative picture in such an important measure, but the flora of the higher plants is not less interesting. Of the lower trees in the undergrowth, one might mention a *Gynotroches* (no. 1970), belonging to the Rhizophoraceae, with greenish flowers and black-purple fruits. One of the Saxi-

[28] Flora der Deutschen Schutzgebiete in der Südsee.

[29] Engler's Bot. Jahrb. LVI (1921), 24.

[30] See Merrill, Bibliographic Enumeration of Bornean Plants—Journ. Roy. Asiat. Soc, Straits Branch, Extra Nr. (Sept. 1921), 7.

fragaceae reaches greater dimensions—*Quintinia* aff. *altigena* Schlecht. (end.) is 20 m. tall. Further, the rutaceous *Acronychia emarginata* Lauterb. (end.) and the myrtaceous *Syzygium adelphicum* Diels* belong to this category. Among the taller trees, the Coniferae (cf. *Fig. 19*), such as *Libocedrus*, *Dacrydium* (no. 2152–3), and *Phyllocladus* (no. 1984), are preponderant, these also appearing in juvenile forms in the undergrowth.

One of the shrubs of this forest is a representative of the peculiar magnoliaceous genus *Drimys*, known from South America, Australia, and Polynesia. It is recognized by the absence of true vessels in the wood, and it resembles the Coniferae in the possession of pitted tracheids which serve exclusively for water-transport. Here is *D. Lamii* Diels*, a widely branched shrub with white flowers; above the forest limit we shall meet still another species of this genus. *Antholoma papuana* O. C. Schm.* was a pleasant discovery. It is a vigorous shrub up to 4 m. tall, with very large flowers (4 cm.) for this family (Elaeocarpaceae); the flowers are axillary, solitary or in pairs, pendulous, and tinted in clear blending colors of red, yellow, and green. This species belongs to one of the genera which, as research progresses on the flora of New Guinea, appear to be common to this country and New Caledonia in constantly increasing numbers. In several families in recent years a relationship between the floras of the two islands has been established. Up to this time, only one New Guinean species of *Antholoma*, *A. Tieghemi* F. v. Muell., was incompletely known. Naturally some Rubiaceae are found here, for example the semi-scandent *Psychotria Lorentzii* Val. (end.), *Timonius* no. 1989 and *T. avenis* Val. (end.). In other families there are also *Symplocos doormanensis* Brand* (also found at 2200 m.), *Evodia aneura* Lauterb.*, *Eurya* (no. 1975), and the semi-scandent *Ilex spicata* Bl. (no. 1978; Arch.). *Utricularia* is very abundant in the moss but is rarely seen in flower.

Here are no large lianas. The only ones are single species of rattan, representing the highest ascending palm species, and also the lowest descending specimens of *Alyxia Lamii* Markgr.* and a single *Rubus* (no. 2037). The clinging *Freycinetia* is very plentiful and is showy because of its salmon-colored inflorescences amongst the green foliage of the ferns and the golden moss-cushions. *Pilea Lamii* Hub. Winkl.* climbs along the lower tree-trunks.

In the closed forest of the broader ridges, apart from a few Urticaceae, herbs are not numerous. *Argostemma montis Doormanni* Val.* occurs here, but this seems to be almost its altitudinal limit. *Dianella carinata* Hall. f. grows everywhere along small brooks and in damp places.

On the sunny narrow ridges, flowers of typical mountain-orchids (nos. 1950–1, 1953) impart color to the moss on the ground and on the lower tree-trunks. Among these are species of *Mediocalcar*, such as *M. crenulatum* J. J. Sm. (also another species, no. 1662), common and striking because of the almost entirely connate inflated and fleshy floral parts with frequently different-colored apices. In such places we find *Glomera palustris* J. J. Sm. var. *subintegra* J. J. Sm., *Dendrobium Lamii* J. J. Sm., *D. mitriferum* J. J. Sm., and *Bulbophyllum acutibrachium* J. J. Sm. A common epiphyte in the moss on tree-trunks here is the zingiberaceous *Riedelia sessilanthera* Val. (no. 1845; end.), with orange-red flowers, likewise *Rhododendron Vonroemeri* Koord. (end.), with light yellow and rose flowers, and *Vaccinium igneum* J. J. Sm.* and *V. brevipedunculatum* J. J. Sm.*, also found at Goenoeng Boetak. In addition, I saw a single pendent *Hydnophytum*. On the open crests a couple of peculiar parasites belonging to

the Santalaceae appear: *Henslowia Ledermannii* Pilger*, closely related to another species of the same genus very common above the forest-limits (*H. acutata* Pilger*), and the much larger *Exocarpus Pullei* Pilger*. The last seems to have its greatest frequency at about this altitude. The first indication I found of its presence was in the form of fallen branchlets at about 2300 m. altitude, but Pilger records [31] the species as occurring from 1440 m. upwards. This parasite disappears with the forest, apart from some very small specimens which I found growing on roots near the highest point of Doormantop. It is here a rather large, about globose, shrub 2–3 m. in diameter, growing on a branch of one of the tallest trees, to which it is attached only in one place. The plant has long protracted phylloclades. The flowers and fruits are located in small receding angles on the sharp sides of the phylloclades, which never are pure green, but which vary between yellow-green and red-brown. The last color is particularly characteristic of the young parts of the plant.

In Beek-bivak, on darker nights I repeatedly saw the phosphorescent phenomenon caused by the mycelium of fungi (no. 1991). Here I had a better opportunity to collect some of it, and I enjoyed the fantastic glimmer uninterruptedly diffused during the night from a part of a thick branch, recalling by its glow the light of Geissler tubes. It was a curious thing to note that, although the fungus did not give the impression of being very heavy, yet it had a weight of some kilograms. Other fungi were also collected here (nos. 1948–9, 1959–60, 1981, 1995).

We did not notice much animal life. A few mosquitoes were seen during the day, but apart from that, as on the whole overland journey, it was not necessary to use the mosquito-net at night. Leeches also were very rare. However, without making any special efforts, we saw almost nothing of larger animals. Everywhere we observed the pungent odor of *Phascogale*, but we never saw the animal. *Koeskoes* (*Phalanger*) and a few other marsupials still occurred here. For that matter it is known that the Papuans use caved-in places in which to trap marsupials above the forest limit, and our expedition also found *koeskoes* above the forest-border. The zoologist, who remained some days longer, caught a number of rats, which appeared to be common everywhere.

* *
*

The trail ascending from the camp first leads over a gently undulating plateau toward the crest. It is a particularly beautiful stretch of forest, with tall trees and a great wealth of ferns in the undergrowth; among these are a few scattered small clusters of pretty tree-ferns (*Cyathea perpelvigera* v.A.v.R.*); the thin crowns of the trees permit a good deal of sunlight to reach the ground. On still mornings there is no sound in this forest other than the gentle patter of the drip from the moss-cushions, no movement except, under the fall of the drip, the up and down swing of leaves of terrestrial plants and of fern-fronds on the tree–trunks. Here suddenly an exceptionally robust species of sterile moss appears in great quantity on the ground. It is a dark green plant with a *Polytrichum*-like habit, about 2 dm. tall and with long divergent leaves; possibly it belongs to the Australian genus *Dawsonia*, and perhaps it may represent *D. gigantea* C. Muell.

On the narrow crest the vegetation is at once entirely different. There are no upright tree-trunks; all are crooked and gnarled, and the moss-covering is

[31] Engler's Bot. Jahrb. LIX (1924), 120.

still heavier than on the ridge in front of Goenoeng Boetak-bivak. The processes which I have previously recorded in the discussion of a similar flora develop quickly here. Rapidly the layer of epiphytes, at first confined to the forest-roof, mingles with the flora of trunks and ground (cf. *Fig. 15*). The undisturbed moss-cushions, at the side of the deep rambling trail, cover every unevenness like snow. There one is not safe from sinking unexpectedly between blocks of stone or between the roots of trees. Now the trail is like a flight of steep rocky stairs; again it follows along roots and a tangle of fallen trunks; in other places it is a muddy trampled slope so much used that it no longer affords any purchase for hands or feet. To the right, far below, a mountain-stream rushes unseen in the endless forest-wilderness of the ravine.

Gradually various known plants disappear; new forms appear, the forerunners of the colorful flora of the treeless territory above the forest-limit. The trees are mostly Coniferae (cf. *Fig. 19*), young specimens being abundant. Everywhere *Nepenthes* with red-green pitchers and *Freycinetia* (no. 1846) with beautiful salmon-colored inflorescences climb through the shrubs. Amongst these, in addition to the young coniferous plants, *Symplocos doormanensis* Brand*, the earlier-mentioned *Quintinia*, *Antholoma papuana* O. C. Schm.*, and *Drimys Lamii* Diels* are very common. Both the last-named species and *Mearnsia ramiflora* Diels extend to the forest-limit. At Goenoeng Boetak the latter was a robust tree; here it is only a shrub about 2.5 m. high, attractive because of its dark red flowers. Here at first *Pandanus* is still very abundant (nos. 1884–5), but at about 2600 m. altitude it suddenly disappears. Now many specimens are seen along the slopes, but a few score meters higher not a single one appears. This altitudinal limit seems to hold everywhere for the genus. Independently of the fact that Pulle [32] named exactly the same height-limits for the southern side of the range, I found the limit to be 2600 m. elevation not only here but also on the southern slope of Doormantop. Somewhat higher still I saw *Utricularia* in great quantity, but at 2700 m. it, too, vanished. At this altitude I saw a specimen of *Podocarpus imbricata* Bl. (no. 2160) for the first time, but apparently this plant, which can be a very tall tree, occurs more abundantly at lesser heights, and about here it reaches its upper limits. Already the vicinity is gay, colorful, and fresh. This forest has no longer the somber oppressive atmosphere of that of the lowlands; the cool mountain air meets us; all day we are in a state of excitement because of the various influences and particularly at the prospect of arriving eventually above the depressing forest. The large *Myrmecodia* (no. 1804) which I first saw at 1900 m., and which has its optimum frequency above the forest-border, becomes increasingly abundant but still remains epiphytic. A number of bright-colored Orchidaceae (nos. 1835, 1997–8) grow amongst the golden-yellow moss, such as *Calanthe manis* J. J. Sm., *Dendrobium mitriferum* J. J. Sm., *D. Lamii* J. J. Sm., *Glomera subeciliata* J. J. Sm., and *Mediocalcar compressicalcar* J. J. Sm. Every moment new species appear. There are here a few other Orchidaceae, the distribution of which seems to be limited to a narrow zone. I saw a couple of species with no greater difference in elevation than perhaps 100 m., which were seen neither above nor below these limits.

In the neighborhood of 2700 m. altitude, I find the first specimen of *Didiscus*, a beautiful plant of the Umbelliferae, one of the commonest herbs above the forest-limits. *Dianella carinata* Hall. f. grows here amongst the moss, but

[32] Maatsch. t. Bevorder v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 68 (1913), 35.

nevertheless it has reached the upper limit of its distributional area at about this altitude. Among the epiphytes the colorful *Riedelia* is more abundant.

At about 2750 m. elevation, we suddenly come to the lower boundary for the mountain *Casuarina*, which immediately appears in large numbers and which, from here upward, with the Coniferae, is practically the only genus of trees represented (cf. *Fig. 19*). In the undergrowth locally is an abundance of fine semi-scandent bamboo. The *Timonius* of Beek-bivak, *T. avenis* Val.*, a robust shrub with yellow-white flowers, grows here, too. Among the remaining herbs new forms continually attract attention, but of the woody plants practically all the species present occur also above the forest-border. However, all are here much more vigorously developed and more slender in habit. At 2800 m. altitude are a couple of specimens of the peculiar orchidaceous genus *Corysanthes* (no. 1815), in which the solitary flower is subtended by a single leaf, the odd purple perianth-segment arching over the others.

The contour of the terrain, particularly here near the critical height of the forest-boundary, has a strong influence on the picture of the vegetation. But where the ridge is somewhat broader and therefore less exposed, or where a depression occurs, everything immediately becomes taller. The strong winds retard the development of plants on exposed places. Somewhat after the appearance of the *Casuarina* we found the first specimens of *Oldenlandia asperrima* Val.*, with large white or pale lilac flowers, a plant very plentiful above the forest-limits. At this altitude also the zoologist finally discovered the long sought-for *Peripatus* in a specimen of *Hydnophytum pauper* Val.* The latter plant grows as well on the lower branches of *Casuarina* and of the Coniferae as in the moss on the ground. Above the forest-limits it is very common and is there naturally only terrestrial. The tuber is gray-white, bare, and irregularly ovate. In terrestrial specimens the tubers lie with the long side in the moss, often almost entirely buried therein; meanwhile the basal end is attached to the substratum by roots; from the apical end a number of short erect stems develop. The small white flowers are in the axils of the rigid thick leaves. The openings of the tuber are very numerous and often, particularly in old specimens, very large, so large sometimes that whole parts of the outermost passages lie exposed. I have recorded [33] elsewhere that this myrmecophilous plant, in the first place, does not harbor ants (perhaps the younger specimens do) but a number of other much larger forms of animal-life. According to the observations of the zoologist, among these are small lizards, beetles, earthworms, a small frog which apparently cares for its brood here, and lastly, often a number of specimens of the noteworthy *Peripatus*, belonging to *Paraperipatus vanheurni* Horst.[34] This genus has gained as much fame as a transition-form between the Annelida and the Arthropoda as through its peculiar distribution (New Zealand, the Cape, N. Guin.). Up to now two species were known from New Guinea: *P. papuensis* Sedgw. from the Arfak Mountains and *P. Lorentzii* Horst from the Wichmann Mountains.

In the neighborhood of 2800 m. the gentle slope changes into a small plateau full of pits and holes. We are still hemmed in by *Casuarina* trees up to 10 m.

[33] H. J. Lam, Iets over de botanische resultaten van de Noord-Nieuw-Guinea-Expeditie 1920—Teysmannia XXXII (1921), 318 and Rectificatie, ibidem XXXIII (1922), 52. Also, Vegetationsbilder aus dem Innern von Neu-Guinea, Myrmekophyten und Insectivoren—H. Schenck & G. Karsten, Vegetationsbilder, Reihe XV, Heft 7, text with Plate 42a.

[34] Zoöl. Meded. Rijksmus. Nat. Hist. Leiden VII (1922–3), 113.

high and by thick coniferous shrubs. After the plateau, the trail again steeply ascends and we reach the first forest-free small summit at about 2850 m. altitude. From here we can enjoy a spacious view for the first time. For a long time we all sit together, gratified at the overwhelming panorama on this exceptionally clear day. Before us to the north lies the Meervlakte, and the long undulating ridge by which we reached this point. To the right and left, we look below into the heavily forested almost bottomless ravines, the view east of which is obscured by a magnificent 4000 m. notched summit. Along its enormous slope, ten white meandering small streams, noiseless and motionless at this distance, descend, unreal, as if drawn with a shaky pen. To the south behind us, but already close, rises the mighty double dome of Doormantop, bare and rocky, rose-brown in the intense sunlight and, even now towards midday, lightly wreathed by the first small clouds. After months of almost endless rains, this seems to be the first of two or three nearly cloudless days.

At the elevation of this small summit only the most exposed points are without trees. Doorman [35] informs us that this is also the case at still lower altitudes; south of the source-streams of the Rouffaer River he found a small peak at 2650 m. free of forest. This same peak was reached by the Nederlandsch-Amerikaansche Expedition of 1926. More than other vegetation boundaries, the forest-limits seem to be due to the contours of the terrain. Still clearer than, let us say, the lower border of the misty forest, that of the closed mountain-forest is sharply defined by sudden changes in the nature of the terrain. Nevertheless, the forest-limit is rather sharp compared to other vegetation-boundaries. As a strongly undulating line (*Fig. 18*), it extends along the 3000 m. elevation, descending on the narrow ridges, rising higher in protected ravines; and, just as more or less forest-free peaks may occur 300 to 400 m. lower than the average, similarly we see that the closed forest may extend as much higher, and indeed does so in the most sheltered and commonly sheer-walled ravines of this terrain. We shall describe this in Fragment VI. . According to the scanty and perhaps not entirely trustworthy information which I received from members of the second expedition (Kremer Expedition), the closed forest of the Coniferae and *Casuarina*, under favorable circumstances, probably ascends to 3500 m. Sapper [36] names 3200 m. as the limit of the deciduous forest in tropical South America; he places that of the coniferous forest at 3800 m. The actual limits of trees are naturally much higher. From photographs of the region north of Wilhelminatop, I think that, apart from open marshy grassy terrain (±3700 m.), I can recognize tree-ferns (specimens with a compact habit and short thick trunk), also *Phyllocladus*, the conifer which extends highest on Doormantop. In regard to tree-ferns, van Nouhuys [37] found a *Cyathea*, with a trunk 3.5 m. long, in a valley on the north side of Wilhelminatop, at about 3650 m. elevation. Probably in the middle of this broad mountainous country —and in general on higher ranges—the vegetation-limits lie on the whole higher than on the much more exposed outer slopes. In Siberia the forest extends much farther north in the sheltered river-valleys than on the ridges between them; possibly, however, other factors are involved, especially drought.

[35] De Aarde en haar Volken, 1918, p. 179, 180.

[36] Geologischer Bau und Landschaftsbild, 167.

[37] Von Rosenstock, Nova Guinea VIII (1910), 716; Wollaston (The Geogr. Journ. XLIII, 1914, 256) says the last tree seen on the very steep southern slope of Carstensztop was at an elevation of 3200 m.

The connection between the temperature of the air and the boundary is treated in a short article of Eckardt,[38] who records the opinions of A. Wegener, F. Ratzel, and H. Mayr.[39] Thus Wegener shows that the tree has the same temperature as the surrounding atmosphere, whereas the lower vegetation can profit by the shelter and by radiation from the ground and therefore can reach a greater altitude. Ratzel states as his opinion that the boundaries separating the biotic regions are not lines but zones, as we have already seen in the above discussion. Above the forest limits individuals can maintain themselves alone or in small groups through locally more favorable circumstances, but a continuous closed forest is no longer possible, since the climate of the most exposed areas hinders the growth of trees. Mayr introduces the concept of "Vegetationstherme"; by that he implies the mean temperature which is necessary for a known plant to thrive during a vegetation period (at least 1.5 months). Each species has its own vegetation-therm and it is thus clear that the forest-margin must lie in the annual isotherm for the warmest month which agrees with the vegetation-therm of the tree (or trees) which forms (or form) the most northerly (or the highest) forest. According to Mayr, in northern Europe this is the "Alpenlarche" (probably here is meant *Larix decidua* Mill.), which appears to have a vegetation-therm of 14° C. The forest-boundary must therefore coincide with the July isotherm of 14°, and that indeed appears to be the case. Also, the mean temperature for *Larix decidua* actually appeared to be 14° both during a vegetation-period of 1.5 months in the alpine region, and during a period of 4 months in the Bavarian highland, also one of 6 months in the Rhine plain and one of 8.5 months in southern France. Naturally the forest-boundary lies a little higher, about at 10°-isotherm for the warmest month.

After having descended the small foresummit, we come again into low forest consisting almost exclusively of Coniferae and *Casuarina*. The vegetation of the small peak consists chiefly of shrubs (no. 1866) such as *Elaeocarpus Pulleanus* O. C. Schm.*, with yellow-white flowers pendent in spiciform racemes, *Drimys Lamii* Diels*, *Mearnsia ramiflora* Diels var. *humilis* Diels, *Symplocos doormanensis* Brand*, and *S. topica* Brand*; within the forest the flora is about like that of somewhat lower regions. The small white- and lilac-flowered *Oldenlandia asperrima* Val.*, already recorded earlier, appears in increasing numbers in the undergrowth. Here is a species of *Cladium*, a very compact plant with stiff leaves spreading like a fan, which becomes very common in marshy places above the forest limits (nos. 1595, 1667). Gradually the trail ascends through the sunny forest wherein the yellow-green and golden-brown tints of the moss, sometimes even interrupted by dark red species, strongly dominate. On the left we can see far over the broad ridge through this shaggy desolate forest; at the right the terrain drops sheer and very deep to the ravine which is limited by the 2000 to 2500 m. high slope of Doormantop. Round about us is the untouched age-old vegetation of crooked thick trunks of *Casuarina* (nos. 1705, 1746), the foliage of this being erect, of thick *Dacrydium* shrubs (no. 2155), of queer compact and hard-leaved shrubs, of moss-cushions, amongst which are conspicuous the bright colors of Orchidaceae (nos. 1818, 1830, 1833), such as *Mediocalcar retusum* J. J. Sm., *Glomera palustris* J. J. Sm. var. *subintegra* J. J. Sm., and *G. Pullei* J. J. Sm., also of *Riedelia* (nos. 1843–4),

[38] W. R. Eckardt, Lufttemperatur und Baumgrenze, Peterm. Mitteil. LXX (1924), 126; cf. also W. Köppen, ibid. 1919, 201.

[39] Literature cited by Eckardt.

Freycinetia (nos. 1592, 1846), and single representatives of the Ericaceae (no. 1996) and the Myrtaceae (no. 1999).

A short and steep ascent over bare rocks brings us once more to a point, whence we cannot refrain from loitering to enjoy the beautiful view. After that we descend a little. Roughly estimated, we are at about 2950 m. altitude. A few new ferns appear, such as *Plagiogyria novoguineensis* v.A.v.R.*, a large terrestrial fern with dimorphic fronds, and *Gleichenia vulcanica* Bl., which occurs on all high mountain-peaks in the Archipelago and forms communities on Doormantop. Here also are the parasites already seen at lower altitude, *Henslowia* and *Exocarpus*, the latter constantly less in number and smaller in size, even as its host-trees become smaller and scarcer. *Henslowia*, however, is parasitic on all kinds of shrubs and is abundant here. As soon as the terrain becomes somewhat steeper we finally emerge from the forest. A small peak covered with a low shrub-growth lies before us, and behind it an extensive steep slope falls off to a vast depth. The end of the large ridge is reached. At this point, where a ridge running in a westerly direction leads to Doormantop, lies Uitzicht-bivak at 3120 m. altitude, the first night's stay above the forest-limit. It was a very special day for us, now that at last we felt the sun and dryness once more. The part of the trail still to be covered is almost wholly in sight; above we see the small white flag that distinguished the locality of Radio-bivak. The camp-location at Uitzicht-bivak was a small flat place covered with grass, somewhat marshy in the center, where a few depressions furnished us with some muddy water. The huts were built on the higher margins, and for the first time sleeping accommodations were arranged directly on the ground and consisted of a thick layer of resilient branches. Round about lay walls covered with low shrubs, and in many places the bare brown weathered rock-formation projected, with lichens here and there (nos. 1836, 2002). In marshy places I found the first specimens of the iridaceous *Patersonia novo-guineensis* Gibbs (end.) var. *auriculata* F. W. Went*; the genus is represented by a rather large number of species in Australia and a couple on Mount Kinabalu in Borneo. It is a small herb, with ensiform conduplicate leaves with sharp edges and a solitary beautiful purple *Crocus*-like flower. Some algae were also collected here. Near the bivouac are a couple of old trees of the mountain *Casuarina*, the wood of which imparted a delicious fragrance to the fire. On the branches of such a tree I found the handsome and large-flowered *Dendrobium simplex* J. J. Sm. (end.), which I had already noted at an altitude of 2000 m. The tuber-like leaf-bases are very hard, shining dark coffee-brown in color, and practically globose; the flower (its parts some centimeters long) is purple and yellow with a background of greenish white. Although the flora here is rather similar to that of the vicinity of Radio-bivak and for that matter can be discussed better in a Fragment devoted to the latter, I must mention a shrub which I saw nowhere else. It is a species of *Scaevola* (no. 1837), a shrub not more than 0.5 m. high, with small hard leaves and relatively rather large yellow-white sessile flowers concealed amongst the foliage.

This day we were all busy with our usual duties, roaming about in the delightful region, and resting at noon. But the approaching twilight brought us together at the margin of the plateau, to gaze over the broad landscape and watch the sun go down behind the western ridges of this rugged mountain land. Only rarely is the opportunity granted to modern man to look down upon a country covered beyond the reach of the human eye with a continuous and

unbroken forest centuries old. The Idenburg River, its bright course gleaming in the dull green of the Meervlakte, flows with huge meanders, with abandoned sections of the old stream-bed in many places, these forming numerous lagoons on either side. Far away in the distance, near the van Rees Mountains, the confluence with the van der Willigen River is to be seen, the latter, although invisible, betraying itself in the landscape by a lighter streak in the forest. The whole mosquito-infested plain lies open before us, and no detail of lagoons, pale green reed-fields, river channels, and various shades of green escapes us now. We recognize and locate the hills over which we left the plain. It seems like a dream, while we now sit here actually suffering from the lashing wind and the cold, with dry clothes and broken shoes, that the land below now literally gasps in the moist heat of the day, that its forests are filled with the screams of cockatoos and the harsh calls of the hornbills; so far away in time and space are these experiences. Once again we search for and find the location of Prauwen-bivak. Now we discover also the blanket stretched at the summit of Casuarisnest, clearly lighted by the setting sun. With the fall of night it quickly becomes colder. The temperature at midday in the shade was 17° to 18° C. and at 8 o'clock in the evening the thermometer stood at not more than 8°. After supper we wrap ourselves in all available covers and lie down on the dry branches to sleep, breathing the fragrance of burning firewood and remembering winter nights full of sparkling stars after a day of skating.

The following morning is as clear and radiant as the previous one, but icy cold. Here and there clouds lie in the deep still dark valley, but the ridges and the highest crenate crests of the range, 80 km. distant, stand out sharply against the clear light. Wilhelminatop, which yesterday was concealed from us, is now entirely clear and is covered with a cloak of freshly fallen powdery snow. In the same excited frame of mind as yesterday we follow the narrow ridge to Radio-bivak. To the right of us is the wide view over the Meervlakte in the north; on our left the view over a series of parallel mountain-chains, back of which the great Baliem Plateau lies hidden, ending in the Central Chain, the Peninggalèh of the mountain-dwellers, wherein the Iniaga, our Wilhelminatop, uncontestedly dominates the scene. The trail is very easy and lies now across a marshy plain, then again over bare rocks, with here and there small clusters of low shrubs. On the other side the slope drops into heavily forested ravines, in which parts of white shimmering small streams are visible amongst the trees. Gradually the ridge becomes narrower and we pass a high landslip on the southern slope, a chaotic mass of huge blocks of rock. Sometimes, however, there is a broader area, and, in such places where depressions occur, a luxuriant small forest of Coniferae develops immediately, with *Plectronia ovalifolia* Val.*, *Ilex spicata* Bl. (no. 1874), *Casuarina*, climbing *Nepenthes*, *Alyxia*, and *Rubus*, and many colorful flowers on the thick moss-covering. Beyond this protected small forest (in which also no. 1869 occurs), immediately follows the last steep climb to Radio-bivak, a barren slope 150 m. in extent. The highest part is irregular; in the sheltered places small trees and shrubs grow. And so on October 16, 1920, we reach the beautiful gently undulating plateau of Radio-bivak (3330 m.), to which I owe one of the most glorious memories of my life. Another Fragment must be dedicated to this and a picture given of the vegetation and the flora of the highest part of this mountain.

VI. Above the forest limits: Doormantop and its vegetation [1]

This is not the first time that botanical collections have been made at about this altitude in the mountains of Netherlands New Guinea. It is, of course, not surprising that, in connection with the different research-expeditions, a strong tendency has developed to attempt to reach, in particular, the region above the timber-line. This tendency is explained not only by modern man's instinctive dislike of a long stay in the sultry forest, but also, since botanists are concerned, by his wish to examine the subalpine flora. The latter frequently promises many surprises and is particularly easy to survey. Rather important collections from above the forest-limits are thus brought together. One of the most important of these is certainly that of Miss L. S. Gibbs,[2] the daring English traveler, who, after expeditions to Kinabalu in North Borneo, Tasmania, New Zealand, and Fiji, visited the Arfak Mountains. Supplementing the large collection of material which she assembled, she prepared an outstanding phytogeographical work on that region. Collections have been made also on the southern side of the Central Chain in the higher mountain-districts. Von Roemer [3] and Pulle,[4] as botanists of their expeditions to the crest of the Hellwig Mountains (2650 m.), collected there. Pulle brought from these mountains and from Wichmanntop (3100 m.) in all some 200 numbers. In addition, van Nouhuys collected single specimens on his expedition with Lorentz toward Wilhelminatop, while Boden Kloss on the Wollaston expedition [5] collected on the slope of Carstensztop. He reached 4150 m., but from that height he brought only a few specimens. Then we have a small collection of preserved material, about 40 numbers, collected by Doorman; these were mostly orchids not definitely labeled, but likely a large part of them came from Doormantop. Finally, the collection of the Australian forester, C. E. Lane-Poole,[6] on some high peaks in the Australian part of the island, the highest of these being Mt. Sarawaket. His description of the vegetation of this peak as well as that of other high mountains is of little value for our purpose, since the treeless areas of this explorer are topographical rather than botanical. His descriptions of the forest at different altitudes, however, are very interesting. Summarizing, we have very complete and well labeled material to about 3100 m. (Gibbs, von Roemer, and Pulle), some specimens from greater heights (Doorman, van Nouhuys, Boden Kloss), and a phytogeographical description of high mountains up to about 3000 m. (Gibbs). My collection and the following floristic sketch can be arranged according to these data. The first consists of 304 numbers,[7] of which about 280 were collected above 3300 m. I believe that the collection of the

[1] Natuurk. Tijdschr. Nederl.-Ind. **89**: 67–130. 1929.

[2] L. S. Gibbs, A Contribution to the Phytogeography and Flora of the Arfak Mountains, etc. (London, Taylor & Francis, July 1917).

[3] Maatsch. ter Bevorder. v. h. Natuurk. Onderzoek. der Nederl. Koloniën, Bull. no. 63 (1910), 22.

[4] Maatsch. etc. Bull. no. 68 (1913), 33.

[5] H. N. Ridley, Report on the Botany of the Wollaston Expedition to Dutch New Guinea, 1912–13—Transact. Linn. Soc. Lond., 2nd Ser., Bot. IX, 1 (1916)—see also: The Geograph. Journ. XLIII (1914), 265.

[6] C. E. Lane-Poole, The Forest Resources of the territories of. Papua and New Guinea (Commonwealth of Australia, 1925).

[7] All named in the text below.

flora from this mountain-top might well be considered complete, apart from the possibility that perhaps I have not observed some plants flowering at other seasons of the year.

The starting point for the discussion of the flora above the timber-line, in this case from about 3000 m. to 3580 m. (the highest part of Doormantop), is the plateau on which Radio-bivak (*Fig. 20, a*) was established. Between Radio-bivak and Uitzicht-bivak very little has been collected. Some plants of that region were already named at the end of the previous Fragment. The others, especially of the slope northeast of the camp, will be treated again below.

FIG. 20. Sketch map of Doormantop; contours at 10 m. intervals, those at 100 m. intervals indicated by a heavier line; a = Radio-bivak; explanation of the other letters in the text; ..... = transport route; the stippled parts are more or less closed low forest.

This plateau has an altitude of about 3330 m. It is an undulating high plateau with an altitudinal variation of several hundred meters, situated east of the true summit. The eastern slope is especially sheer and deep, frequently 1500–2000 m. without interruption, except at the point where the ridge which formed our path joins the plateau and where the steep part is not more than about 150 m. high. Along the entire western side of the plateau the steep part rises, a great crumbling wall of the summit-plateau about 100 m. high; the real summit is rather broad and indented, as was already observed from the Meervlakte. The highest point lies directly west and is separated from the broad eastern summit by a deep ravine (*Fig. 20, k*) descending in the direction of the northern slope and near the south ending blindly in a high saddle (*Fig. 20, m*) which binds the two summits together. The eastern summit shows again this character of an undulating stone-plateau, the western falls away steeply on all sides except towards the south-southeast slope, being by far the most precipitous

towards the southwestern side which cannot be scaled without aids, and where the slope of 60° and more continues for several hundred meters. On the north side of the bivouac-plateau some small ravines (*Fig. 20, f, g*) with a luxuriant flora lead from the margin. On the south side one finds a broader and deeper sheltered ravine, its very steep sides (*Fig. 20, h*) covered to the margin by an upward extension of the forest.

The bivouac-plateau is characterized by three outstanding types of vegetation, naturally showing many transitions.

A. The rocky terrains.

B. The fern- and shrub-scrubs.

C. The marshes.

In the discussion I shall consider each in turn.

The largest area is that of the rocky terrains.[8] Here are convex folds and gently sloping areas where the surface is covered with boulders of all sizes. These are all formed from the basic eruptive rock-formation that Gisolf [9] has further described and they show a typical Karst topography [i. e., marked by sink-holes, interspersed with abrupt ridges and irregular protuberant rocks, and by caverns and underground streams]. The newly broken surface is green-gray in color, but when weathered is of a smooth light gray-brown tint in which brown is dominant. At disintegration frequently rows of furrows are formed, separated by narrow and often very sharp edges. This makes traveling in bare feet over this area very difficult. Furthermore, the rock-formation, according to Gisolf, consisting of magnesium-olivin and a colorless mineral (antigorite and antigorite-serpentine), is permeated everywhere with magnetite (polar magnetic iron ore, FeO and Fe_2O_3) which lies enclosed in parallel bands in this rock-formation; meanwhile on the surface the magnetite stands out some centimeters on account of its greater hardness. This magnetic iron had already played a trick on Doorman. He found, when making a survey of Wilhelmina-top with regard to the spot earlier placed at the south side, an error of not less than 14°, which he could not explain. Capt. Kremer, who repeated the survey, with Doorman's results in mind, first obtained a deviation of −8°, thereafter at another place one of +25°. Still later, the compass needle, even on two places close together, appeared to differ 180°. Now it became clear that the earth itself must play a role in these phenomena; indeed then very quickly the magnetic ore was found, and the geologist and I took along samples of it. The rock-formation, from which the iron-mass was removed as much as possible, contains still, according to the analysis, 7.69% FeO; 40.46% SiO_2; 40.2% MgO; 4.12% Al_2O_2, and 7.74% H_2O. Although the rock-formation in itself is tolerably heavy (S. G. 2.5–3.5), the iron ore with its specific gravity of about 5–6.5 increases the weight very considerably; hence the transfer of the samples did not particularly please the carriers.

In the humus collected in crevices between these boulders, a very dwarf flora of small crowded or creeping shrubs and a few herbs has taken root, while the stones here and there are covered with lichens (nos. 1836, 2002, 2015–7). Amongst the shrubs here species of *Styphelia* in particular, such as *S. Van-*

[8] See the illustration of Doormantop in Schenck & Karsten, Vegetationsbilder, Reihe XV, Heft 5/6, Tafel 34.

[9] W. F. Gisolf, Over het gesteente van den Doormantop in Centraal Nieuw-Guinee—Verslag Gew. Vergaderingen Wis- en Natuurk. Afd. Akad. v. Wetensch. Amsterdam, XXXII (1923), 160.

nouhuysii J. J. Sm. (end.) and *S. Dekockii* J. J. Sm. (end.), are strongly represented; these are small compact bushes 1–2 dm. high, easily recognizable by their somewhat stiff and frequently pointed small leaves with curving veins, crowded and appressed along the stem. *Styphelia Dekockii* J. J. Sm. is a larger shrub up to 1.5 m. high. In the smaller species the stem often creeps forward some meters along the ground. Also here is *S. abscondita* J. J. Sm.,* with white flowers. The Epacridaceae, to which these plants belong are, just as the nearly related Ericaceae, true mountain-plants in the tropics, although a few species occur in the lower regions. Whereas the Ericaceae have a very wide distribution, the Epacridaceae belong especially to the Austro-Papuan area, with off-shoots to British India on the one hand, and to Oceania and South America on the other. Another very common shrub here is *Xanthomyrtus Klossii* Diels (end.) var. *brevipedunculata* Diels*, with more or less dark yellow flowers. This shrub, like the common *Decaspermum prostratum* Diels*, with pale cream-colored flowers often tinged with purple, remains very low, the long branches creeping some meters over the bare earth. Both species possess very small and coriaceous leaves. Another plant characteristic of this region is the low-growing (about 0.5 m. high) *Drimys fistulosa* Diels*. The few branchlets bear, on the distal portions only, a number of densely crowded leaves, which near the tip are closely appressed against the stems and are revolute for almost their entire length (hence the specific name); the small white flowers occur near the tips of the branches, hidden among the leaves. Both *Drimys* and *Oldenlandia asperrima* Val.*, mentioned in the previous Fragment, grow by preference in sheltered places among taller shrubs, although they still seem to choose the stony ground rather than the fern- and bush-scrubs. The Rubiaceae are represented here by many other species, such as *Oldenlandia nutans* Val.* (end.), *O. coprosmoidea* Val.*, *Coprosma ulicoides* Val.*, and *Plectronia ovalifolia* Val.* In some places a few larger shrubs 1–1.5 m. high appear together. A number of these belong to the Ericaceae, especially to *Vaccinium*, *V. ciliatipetalum* J. J. Sm.*, *V. cyclopense* J. J. Sm., and nos. 1596, 1676–7, and 1679. Rather common among them is a singular species of *Eurya* (no. 1720), the whole plant being laterally compressed with oblique branches lying in a single plane and hence suggesting the form of a fishbone. Moreover, the plant is shaggy in all parts and compact in habit, with small green-white flowers. There are still a few larger shrubs 2–2.5 m. high always growing in somewhat protected areas. Some of these are *Vaccinium molle* J. J. Sm., *Quintinia Schlechteriana* O. C. Schm.*, and *Acronychia murina* Ridl. (end.). Somewhat smaller are *Syzygium Chamaebuxus* Diels*, with yellow flowers (of the known species of *Syzygium*, this one reaches the highest altitude), and *Drimys pittosporoides* Diels*.

Whereas most bushes, except *Xanthomyrtus* and a few Rubiaceae and Ericaceae, have comparatively small and dull-colored flowers, among the herbs several immediately attract attention because of vivid colors and the relatively large size of the flowers. In this connection a beautiful orchid deserves particular mention. It is *Dendrobium Vannouhuysii* J. J. Sm. (end.), a small plant which, with its comparatively large deep-orange flowers and its thick purple-orange fruits, is found everywhere among the rocks on the ground. Also striking because of their color are the few dark cobalt-blue gentians. One of these (no. 1623) is identical with or closely related to *Gentiana singgalangensis* Backer, described from Central Sumatra; another specimen (no. 1624) is a near

relative of the endemic *G. Lorentzii* Koord. Number 1778 is perhaps a third species, growing in somewhat moist places. The size of the first-mentioned species of *Gentiana* is strongly influenced by its habitat. The height of the plant varies from 2 cm. in the most exposed places to 25 cm. in the shade of taller plants. The second (no. 1624) is always more slender than the first and has thinner and more acute small leaves.

Another conspicuous and exceedingly common plant of these bare rocky fields is a mountain-form of *Nepenthes Vieillardii* Hook. f., previously known only from New Caledonia. One finds climbing plants of this species everywhere up to the forest-margin, but as soon as the trees disappear only very short terrestrial individuals are seen. These are observed as far as the summit. Unfortunately no specimens of the climbing forms were collected, and so it cannot be said with certainty that the two forms represent the same species; hence further investigation is necessary to discover the lower limits of this species. The terrestrial form never grows taller than a few decimeters; even in shrubberies I did not find any longer specimens. The thick rosette of stiff boat-shaped somewhat twisted leaves scarcely rises above the ground, and the pitchers lie all around the plant on the bare earth or in the moss. Older plants have a stiff crowded terminal inflorescence. The young leaves are green but quickly become red to red-brown. The pitchers likewise are green or brown, the margin and the lid being flecked with red. The new unopened pitchers contain much water, in older ones remnants of insects can always be found. In both sexes the floral envelope is dull brown outside, dark violet within; the young filaments are green, becoming violet-red, with light yellow anthers; the style and the stigma are green-red. The entire flower very quickly becomes brown; the perianth is marcescent, the fruits dull brown.

In addition to *Nepenthes*, we note a few very small Compositae (nos. 1589, 1629, 1700, 1754); one of these (no. 1700) grows by preference in small rain-pools on hard ground otherwise without vegetation. This plant is related to *Crepis* and has bright yellow inflorescences (small flower-heads), which contrast prettily with the dark brown-green of the stem and the basal rosette. Number 1629 also prefers moist habitats. In this plant-association numerous orchids occupy an important place. Two of them are wholly green, *Habenaria Lamii* J. J. Sm. and *Peristylus ciliolatus* J. J. Sm. and its var. *apiculatus* J. J. Sm. Both have a small basal rosette and a very tall sparsely leafy scape. These plants are scattered in clefts of rocks or in open spaces between them. *Calanthe Versteegii* J. J. Sm. is more showy with its larger greenish white flowers, and more abundant. In moss-cushions or amongst ferns are *Glomera Dekockii* J. J. Sm. var. *Lamii* J. J. Sm.* and *G. grandiflora* J. J. Sm. var. *minor* J. J. Sm.; whereas *G. Pullei* J. J. Sm. and *G. fruticula* J. J. Sm. prefer more open land. Other Orchidaceae of the habitats discussed are *Bulbophyllum cavibulbum* J. J. Sm., *Chitonanthera suborbicularis* J. J. Sm., *C. trigona* J. J. Sm., *C. Lorentzii* J. J. Sm., *C. calceiformis* J. J. Sm., *Octarrhena tenuis* J. J. Sm., *Phreatia nutans* J. J. Sm. with nodding flowers, *Pedilochilus terrestris* J. J. Sm. and *P. obovatus* J. J. Sm., both on somewhat damper areas hidden among ferns, and lastly *Dendrobium erythrocarpum* J. J. Sm., which is usually epiphytic on shrubs.

A pretty *Euphrasia*, related to *E. borneensis* Stapf of Kinabalu (N. Borneo), is likewise common in dark humus among bare rocks. It is a small erect herb (no. 1587) with nearly orbicular leaves and fairly large white flowers crowded together or a few at the apex of the stem. In the same habitat the

yellow-orange-flowered *Dendrobium Vannouhuysii* J. J. Sm. grows abundantly, with a species of *Cladium* (no. 1595). The leaves of the latter are ensiform, as are those of *Patersonia novo-guineensis* Gibbs, and conduplicate, spreading in one plane, the plants hence being somewhat fan-shaped. In the sterile condition one could easily confuse the two plants [10] were it not for the fact that, in addition to being much more rare, *Patersonia* is recognizable by the rough brown-hairy margin of the folded leaf. Moreover, *Patersonia* always prefers damper situations, but the species impressed me as being somewhat more rare here than at 3100 m. altitude. Another common plant is *Gahnia* (no. 1748, perhaps *G. psittacorum* Labill., known from N. Guin., Austr., N. Zeal.), conspicuous on account of its growth in thick clumps and its waving inflorescences of shining brown color extending above the lower plants; the glistening fruits are yellow-gold and hang on thin brown stalklets outside the floral envelopes. In open areas a species of *Schoenus* (no. 1810) and a number of grasses (nos. 1638, 1682, 1745, 1774, 1816) form similar isolated clumps which frequently protrude somewhat through the washing away of the soil. Often a few plants of *Lycopodium* creep forward between these small clumps. I collected seven species of that genus on the highest part of Doormantop. *Lycopodium scariosum* Forst. (Mindanao, Austr., N. Zeal.) grows among the rocks, and *L. carolinianum* L. (trop. and subtrop.) var. *pedunculatum* v.A.v.R. on moister earth. The latter is very short since the older parts die quickly as the tip grows forward.

I mention last one of the most striking plants, almost dominant in some stretches, the large *Myrmecodia* (no. 1804) which I observed first as an epiphyte at an altitude of 1900 m. (Fragment V). It is epiphytic in all forest-margins, but at the highest point of the naked summit it is a very common terrestrial plant. On account of its frequency as well as its size, this species forms a characteristic element of the vegetation. In the plant-association now under discussion, the flora of the barren terrains, it is outstandingly terrestrial, in the shrubberies more often epiphytic. In the first instance the giant tuber-like base is often 1 m. high, upright, with numerous long stems stretching out in all directions. As an epiphyte the plant may be attached in a variety of ways to the trunk or branches, on the trunks frequently being lateral and then with a somewhat elongated curved tuber-like base and upright stems; on horizontal branches it is often upright. The roots then usually extend over long distances along the branches and the trunk of the host, and sometimes thus even reach the ground. One might ascribe [11] to such roots not only the function of clinging, but also the function of water- and mineral-transport. Pulle noticed the species on the south side of the Central Mountain Range,[12] the Second Lorentz Expedition found it as a terrestrial [13] at an elevation of 2550 m., if one may assume that, in all these cases, we are concerned with the same as yet undescribed species. I have elsewhere dealt with the species in greater detail with the aid of a number of illustrations,[14] so that here I merely give a reference to

[10] This apparently was done by F. W. Went (Nova Guinea XIV, 1, 1924, 114), who determined a sterile specimen with glabrous leaf-margins as *Patersonia* sp. Doubtless he had this *Cladium* before him.

[11] O. Beccari, Malesia II, p. 177.

[12] A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, p. 158, fig. 25b.

[13] Maatsch. t. Bevorder. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 62 (1909), 41.

[14] H. J. Lam, Vegetationsbilder aus dem Innern von Neu-Guinea Vegetationsbilder, Reihe XV (1924), Heft 7, Tafel 37c, 38–41.

the detailed consideration. I shall only point out that these plants are spread by birds (or ants?),[15] as often an enormous number of young plants and seedlings may be found on the tuber-like stems and in the immediate vicinity of these plants. The dwellers in this species are always ants; the entrances to the cavities are small and few in number and are located on the lower side of the tuber-like stems.

Another myrmecophyte in this region, already mentioned in a previous Fragment, is *Hydnophytum pauper* Val.* (no. 1641; Fragment V). This plant, also discussed elsewhere,[16] is very abundant in the dense margins of fern- and shrub-scrubs, so that by mentioning it, a suitable transition is formed to the discussion of that plant-association. I have already noted that this species often harbors, in addition to ants, a number of larger forms of animal life (among others, *Peripatus*). At this altitude, in particular, it probably is a small frog which lives and rears its brood here. At night one hears its shrill whistling cry, but one never catches sight of it during the day.

The fern- and shrub-scrubs are level but not marshy, frequently being gently sloping portions of the terrain, which, without being noticeably sheltered in comparison with the surroundings, are covered with very densely crowded herbs and shrubs. They well illustrate the extraordinary sensitiveness of the vegetation-habit to extremely small differences in local climate. We must suppose that these plants develop on those parts of the drier stony terrains which, either through their situation or the nature of the slope or its form, have provided more favorable living conditions than have the surrounding areas. The borders, either on stony land or on the edges of small marshes, are formed of thick moss-cushions and fern-associations. In the center is a more or less high growth of shrubs, giving one an impression that this difference in plant-covering is due to slight elevations of the land. The measurements and the height of the shrubby forest differ much in connection with the stands, the contour of the ground, the altitude above the forest-limits, and the exposure. Various transitions from the small shrub group to the closed rain-forest are found, so that these places may be compared with small islands, adjacent to a continental coast, formed by surf-erosion. In such a plant association one may expect to encounter a number of species which also occur in the rain-forest of higher altitudes, and that is indeed the case. The margins, either narrow or broad and meadow-like depending upon the steepness of the slope, are overgrown with two fern-species rooting in the dense moss-covering. Both *Gleichenia vulcanica* Bl. var. *plumosa* v.A.v.R.* (type collected near forest edge; *Fig. 21, left*) and *G. subulata* v.A.v.R.* (*Fig. 21, right*) form closed associations. The first extends nearer to the margin of the plant-association beyond the protection of the taller-growing plants, its numerous and pretty dichotomous fronds (brown-woolly beneath) standing somewhat oblique. Entire zones of the second species occur especially along the margin of the shrub-vegetation, frequently partly shaded, the shining fronds being elegantly arched on their dark stipes. In the shelter of this thick fern-vegetation, rooting in the thick mossy layer, one finds a number of herbs more luxuriant than in the open terrain. The mossy layer contains *Macrohymenium laeve*, *Macromitrium recurvum*, *M. perobtusum*, *M. armatum*, *Brotherobryum latifolium*, *Schlotheimia*

[15] W. Docters van Leeuwen, Mierenepiphyten, De Tropische Natuur, XVIII (1929), No. 4, p. 57.

[16] H. J. Lam, Vegetationsbilder, Reihe XV, Heft 7, Tafel 42A.

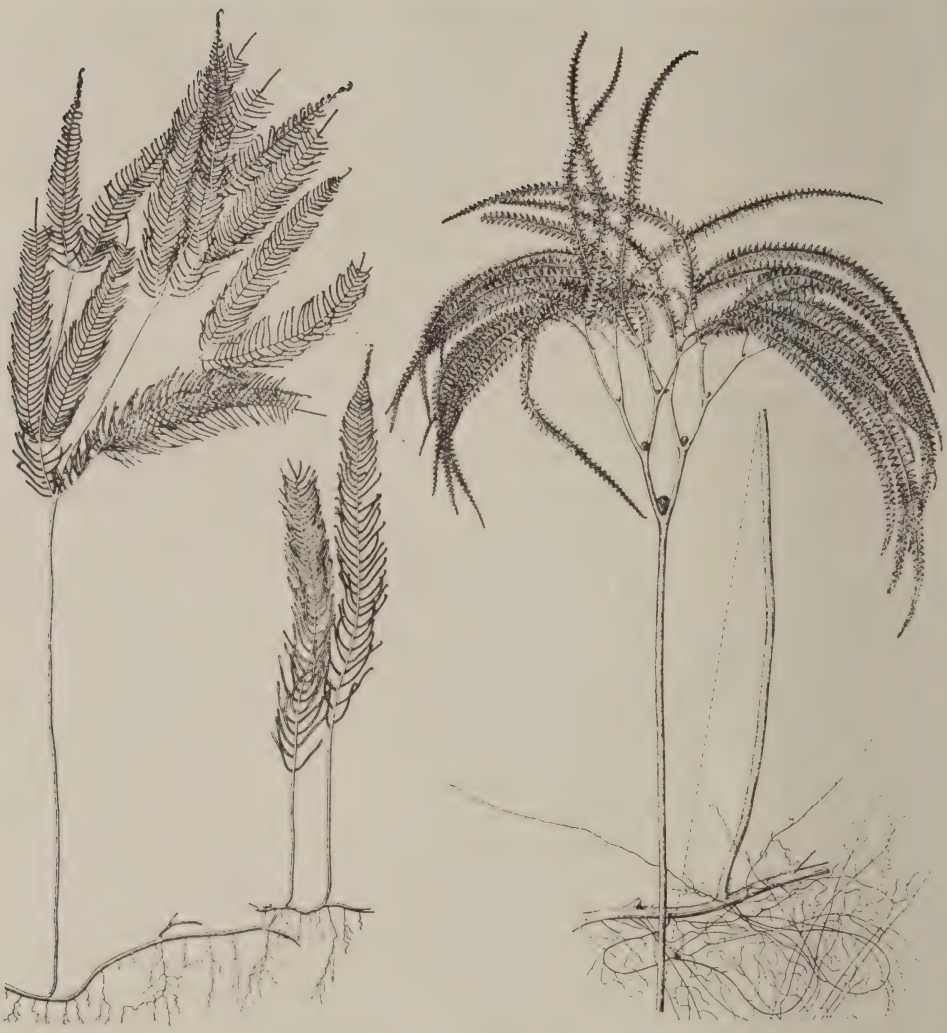

FIG. 21. (left) *Gleichenia vulcanica* Bl. var. *plumosa* v.A.v.R. (Darmosoediro del.); (right) *Gleichenia subulata* v.A.v.R. (Sandiwiro del.).

Lamii, *Thysanomitrium MacGregorii*, *Braunfelsia scariosa*,[17] and nos. 1680–1681. At the margin the plants are still small and there we also find the low-growing species which toward the center cannot compete with the higher-growing plants, for example, two species of *Gentiana* (much larger here), a *Euphrasia* with white flowers, and the orange *Dendrobium Vannouhuysii* J. J. Sm. *Mediocalcar crenulatum* J. J. Sm., with variegated flowers, is abundant. The flowers of this species are deep red in both forms, the tips of the short lobe in one (no. 1599) being bright green, in the other (no. 1642) white or yellow-green. A few species of *Lycopodium* grow on the very outer margin of this plant association, such as *L. complanatum* L. (north of the equator and

[17] I am indebted to Professor Max Fleischer for his kindness in determining the mosses.

alpine tropical regions) var. *angustiramosum* v.A.v.R. (end.), with creeping stems and upright branchlets, and *L. hydrophilum* v.A.v.R. (end.) var. *eciliolatum* v.A.v.R.*, also growing in small marshes. *Bulbophyllum muricatum* J. J. Sm., with yellow and purple flowers, occurs here, and also rather scattered plants of the liliaceous *Astelia alpina* R. Br. (high mountains of N. Guin., Queensl., and Tasm.); the latter is a small plant with silver-white, hairy, thick, perpendicular stems entirely hidden in the moss, above which the narrow white hairy leaves hardly protrude; the inflorescence of greenish and somewhat membranous flowers reminds one of the Juncaceae rather than of the Liliaceae. The peculiarity of this plant, however, is the root-system, which is much larger than the rest of the plant, a number of thick pale brown soft lateral roots penetrating the moss-layer almost perpendicularly for a few decimeters. Still further from the margin in these fern-scrubs one observes *Lycopodium laxum* Pr. (S. E. As.—Polyn., Austr.), with dark green foliage creeping among other plants, also *L. tomentosum* v.A.v.R. (end.) and *Schizaea fistulosa* Lab. (Madag., Austr., Tasm., N. Zeal., N. Caled., Chile).

All these plants prefer a certain zone within these shrubberies, in almost all of them the beautiful *Didiscus* (nos. 1586, 1674; aff. *saniculifolius* Stapf) occurring in the margins and among the taller-growing ferns. The lower limit of its range seems to be 2700 m. The genus is known from Australia, New Caledonia, and North Borneo (Kinabalu; type of the species collected on this mountain). Not only the previously mentioned *Gentiana* and *Euphrasia*, but also this *Didiscus*, are subject to the growth-inhibiting influence of light. In open places strong evaporation is also an influencing factor. In fully exposed places I observed plants scarcely 6 cm. tall, whereas those growing in the *Gleichenia* association were up to 40 cm. tall. In open exposed places the plant consists of a small basal rosette of leaves and a short peduncle; in the thickets the ascending stem develops long internodes from the basal rosette with long peduncles. The basal leaves are thinly and shaggily long-hairy, long-petiolate, and spatulate with a gradually narrowed base and a rounded dentate apex. In full light the leaves lie, as if asleep, pressed against the ground,[18] among other plants pointing obliquely upwards. The peduncle is brown-yellow, the umbel surrounded at the base by protecting bracts frequently showing in all parts a more or less strong purple coloring. The corolla is pale pink, but the fruit and pedicels, wherever exposed to direct sunlight, are dark purple. Sometimes I observed and collected inflorescences illustrating continued growth, in which one or more flowers were replaced by a secondary peduncle.

In this plant-association, the only representative of the Zingiberaceae which I observed in this region was *Riedelia montana* Val. (no. 1678; end.) as a scattered terrestrial among the ferns and once as an epiphyte on a small tree. The corolla is pink, the calyx and pistil dark purple, the violet bracts being covered with a waxy bloom.

The shrub-zone of these scrubs is surrounded by a girdle of *Gleichenia subulata* v.A.v.R.* In between are numerous more or less stiff Orchidaceae, such as species of *Glomera* and *Chitonanthera* with small salmon-colored or pale

[18] Senn is of the opinion (Untersuchungen über der Physiologie der Alpenpflanzen—Verh. Schweiz. Naturf. Ges., 1922, II, sep. p. 13) that, for some alpine plants the leaves of which lie close against the rocks warmed by the sun, one must accept positive thermotropism, but I do not believe that would apply to *Didiscus* as it grows here.

orange flowers, tough long leafless stems, and small thick leaves at the apices of the branches. *Glomera manicata* J. J. Sm., with white flowers except for the blood-red lip-tip (in other species the tip is frequently black or brown), is common here. A few lianas wind themselves through this vegetation and around the branches of shrubs; among these are two species of *Alyxia*, *A. Lamii* Markgr.* and *A. cacuminum* Markgr.*, and a species of *Rubus* (no. 1585) with leaves densely rust-brown-hairy underneath and pale cream-colored flowers.

Among the shrubs of this terrain, in addition to the ubiquitous Coniferae, which in the more protected places become trees, and *Casuarina*, we observe many of the same Ericaceae mentioned above for stony ground, but frequently here with a more robust habit. The often dominant species of *Vaccinium* and *Rhododendron* have mostly reddish flowers. Usually represented are *Styphelia obtusifolia* J. J. Sm. with yellow and *Symplocos mamberamo* Brand with white flowers, and particularly *Drimys pachyphylla* Diels with revolute firm leaves and fairly large white flowers. A few previously mentioned species of Rubiaceae, such as *Plectronia ovalifolia* Val.*, occur. In more open places among the shrubs, but always on sheltered ground, is an occasional dwarf tree-fern, *Cyathea imbricata* v.A.v.R.* A fungus (no. 2013) grows on dead wood.

In the middle of the small forests are the tall shrubs and small trees, the branches covered with isolated moss-cushions (among others a liverwort, no. 1698), a few epiphytic ferns (no. 1699), and orchids (no. 1767). The woody genera here are almost exclusively coniferous, such as *Dacrydium* (no. 1773), with dark, thick and hard foliage, *Phyllocladus* (no. 1742), with thinner branches and phylloclades often touched up with red-brown color, *Libocedrus* (no. 1788), frequently showing a clear story-structure, the lower surface of the phylloclades usually covered with a waxy bloom, and lastly, the more rare *Podocarpus*, which mostly prefers still more protected places in these small shrubby forests. Also in the middle are a few plants of the previously mentioned *Casuarina* (nos. 1705, 1746). This tree, however, apparently does not assume a shrub-form, and in addition prefers a manifestly more open habitat. Nevertheless, it is not at all particular as far as its location is concerned; it grows as well in the midst of a mossy cover as among bare rocks, and just as well on level as on steeply sloping ground. This tree and *Phyllocladus* grow closest to the summit. Up to about 3500 m. altitude, I observed specimens 1.5–2 m. high. Earlier I mentioned that the lower limit of this *Casuarina* lies at about 2750 m.; the upper limit is not far from 4000 m. altitude. In free growth it is a robust but usually crooked gnarled tree giving a peculiar impression with its broad yet very thin crown of upright slender shoots. The latter, especially in the flowering staminate specimens, bear an unusually strong resemblance to *Equisetum*. In both Javanese forms, *C. equisetifolia* Forst. (for which the specific name is less apt than it would be for the species here discussed) and *C. Junghuhniana* Miq. (the mountain-plant which perhaps is not more than a montane form of *C. equisetifolia*), and in other species of the Archipelago, the longer shoots are more or less pendent. Probably we have here a representative of an Australian species of *Casuarina*. Bentham and von Mueller [19] recorded 19 species; later, Moore [20] described a few more, among them one with upright shoots. The

[19] Flora Australiensis VI (1873), 192.

[20] L. Moore, Journ. Linn. Soc. Bot. XLV, no. 302 (1920), 193.

genus is chiefly Australian, but a few endemic species occur in New Caledonia.[21] *Casuarina equisetifolia* Forst. is the only one of wide distribution (E. Afr.—Polyn.), and this is because the fruits may be dispersed by sea-currents. It is found chiefly on very sandy coasts.

The Doormantop *Casuarina* grows about 8 m. high. The staminate inflorescences are beautiful dark red; this tree frequently furnished us with firewood which emitted an agreeable odor suggesting that of resinous pine. The large branches are often covered with the large *Myrmecodia* and its numerous seedlings. The tree forms a very picturesque entity, with its broad base surrounded by shrubs and yellow-green moss-cushions, and its branches covered with brown-red or even dark red moss.

Finally we come to the discussion of the third plant-association, that of the small marshes. They are shallow boggy sunken places which may or may not have water-drainage; the vegetation is very scanty; the margin is formed by the more moist vegetation of fern- and shrub-scrubs or by miry spots between bare rocks. The real marshes are covered with widespread clumps which stand out as little islands above the water. These consist chiefly of a species of *Cladium* (no. 1595), more rarely *Schoenus* (no. 1810), and an occasional species of grass. In addition, one finds Compositae (nos. 1629, 1700) in these clumps, and generally *Euphrasia* (no. 1587), which is dominant after *Cladium;* its small white flowers protrude everywhere above the stiff clumps of the cyperaceous plants.

The water of some of these swamps is rusty brown. Whether this is to be attributed to bacteria rather than to iron-content, or perhaps to both, I am unable to say. Everywhere are many green, and probably also blue-green algae (nos. 1731–3, 1756, 1761–3, 1775, 1787, 2004–5), especially in places where the water flows in broad shallow streamlets over gently sloping rocks, amongst a vegetation of *Lycopodium carolinianum* L., or in crooked little channels among higher-growing grasses and sedges. They show all shades of light green to brown- and purple-green. On the border of these small marshes and the stony bare ground, we usually find characteristic creeping Myrtaceae, such as *Xanthomyrtus Klossii* Diels var. *brevipedunculata* Diels* and *Descaspermum prostratum* Diels*, with its branches, often several meters long, lying flat on the ground and taking root; during a rain they frequently stand under water.

I observed another type of marsh-vegetation in the upper parts of some ravines which descend on the sides of the Radio-plateau. Here the flora is richer; this is particularly true of the largest of these marshes (*Fig. 20, n-p*), lying at the entrance to the large ravine on the southeast side of the plateau (*Fig. 20, h*). When one descends through a shrub-forest with tall grasses and light green *Lycopodium laxum* Pr., one comes upon a gently sloping miry valley-bottom [22] lying somewhat sheltered between the high slope of the second plateau on one side and a small foresummit on the other margin. The water flows slowly between tall grass-clumps which are dominant here; and the many small waterways at the lower end form a brooklet which falls somewhat further along into the bottomless mossy ravine. Among the grasses are many plants of an attractive robust *Potentilla* (nos. 1702, 1764), strongly resembling and without doubt closely related to the silver-weed (*Potentilla Anserina* L.) and

[21] Id., l. c. no. 303 (1921), 414.
[22] Vegetationsbilder XV, Heft 6, Pl. 26b.

perhaps identical with *P. leuconota* D. Don of the Himalayas and high peaks of intermediate regions. The very large flowers are bright yellow with frequently reddish calyx-lobes. Another reminder of the northern flora is a *Cynoglossum* (no. 1765), which resembles a *Myosotis*, a very small shrub or undershrub with white flowers and very firm thick small leaves. A third is a much rarer *Viola* (no. 1673), growing at its lower limit; in the highest saddle at almost 3500 m. altitude it is much more plentiful. Among the grass-clumps is *Lycopodium scariosum* Forst., and on the drier margins other species of the same genus.

I searched in vain for a species of *Ranunculus* occurring not only on the mountain peaks of Java, but, according to Pulle [23] and Ridley,[24] also on the south side of the Central Mountain Range.

The large ravine (*Fig. 20, h*) [25] mentioned above has a much richer flora than the valley-bottom at the entrance. Without doubt this is due to the fact that the walls suddenly slope steeply, so that the deep-lying valley is entirely sheltered on three sides. A picture of the vegetation, therefore, makes one think of that of much lower regions, a true pontic [26] flora, with unexpectedly tall forest for this altitude (3320 m.), in which everywhere pairs of white butterflies flit to and fro and a number of other insects are swarming about. The characteristic plant of this ravine is a tall coniferous *Libocedrus* (no. 1788), a large tree attaining a height of 15–20 m., with a thick straight trunk and a beautiful umbrella-shaped crown. The sharply ascending branches of this stately and decorative tree are covered with yellow and red moss-cushions; often it also supports a number of plants of the large *Myrmecodia*. This ravine is most beautiful in the mist. The silence is unreal and is still more striking when the fog limits the sphere of vision and the orbit of interest to the immediate surroundings—a silence broken only by the uncanny creaking of trunks and branches grating against each other in the plaintive howling of the wind, and the patter of the drip falling incessantly from the moss-cushions on the leaves of the low flora. Even on us such customary sounds as these have a strange effect at times, as if they represented another world. Still, these surroundings impressed me as a much more harmonious whole in the mist than in the sunshine, perhaps because, in the presence of the mist, the isolation was felt unconsciously rather than consciously and seemed to be the strongest feature of the landscape. The fantastic cypresses appear as capricious silhouettes against the fog; those close by are dark and clear, those more remote are lighter, and those farthest away can scarcely be distinguished from the streaks of light which flow into each other and the gliding shadows of the clouds; the bleakness of the wind forcing the clouds through the ravine is in perfect harmony with the ghost-like tree-forms and the inexplicable sounds. Suddenly the nearby familiar guttural

[23] A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, p. 158, and Maatsch. t. Bevord. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 68 (1913), p. 36.

[24] H. N. Ridley, Report on the Botany of the Wollaston Expedition to Dutch New Guinea 1912–13—Trans. Linn. Soc. London, 2nd ser. Bot. IX, 1 (1916), 8, 10.

[25] Vegetationsbilder, l. c. Pl. 27, 28a, 39.

[26] This expression is used for plants really belonging in warmer or more southern regions rather than those corresponding with the geographic latitude or altitude of the habitat. The word is derived from "Pontus" (a mountain region in N. E. Asia Minor), because there, in favorable habitats, one encounters some plants characteristic of the more southern and warmer regions. In Europe such pontic plants are mostly considered as relics of a widely spread steppe-flora in the diluvium, which withdrew by reason of a climatic change owing to the glacial period or some other cause and survived only in favorable places. They form a counterpart for the glacial relics, i. e., plants immediately following the ice-covering instead of fleeing from it.

sound of a lizard recalls one to reality, or the loud chirp of a swallow skimming by is like a bit of reality which unexpectedly appears, passes through, and vanishes from the small mysterious world of the mist.

It soon appeared that the real valley-bottom of this ravine is impassable. Wherever one descends along the steep slopes, one reaches the margin of harmless-looking moss-coverings which, however, conceal treacherously deep crevices and masses of decayed wood. It is almost impossible to penetrate more than a few meters into the moss-covered area, except with the sacrifice of much time and the possibly good chance for an unexpected fall. Deeply hidden under the moss an unseen brook murmurs and gurgles. Most of the plants which are common in the barren mountain-meadows occur here, but with a more robust habit and larger size. In addition are two species of *Dacrydium* (nos. 2151, 2154) and a *Podocarpus* (no. 1789), a thick robust tree-shrub with small firm leaves; the last genus does not occur here above the forest-limits. A fact immediately attracting attention is the large number of hygromorphic plants, the leaves of which are large and thin compared with those previously mentioned. This is most apparent in a species of *Homalanthus* (no. 1801), a large tree-shrub with the usual aspect of this genus, which looks strange in these surroundings. It is also peculiar to find here an abundance of tall tree-ferns, three or four species in the undergrowth. I obtained only one specimen representing a moderately tall *Alsophila aeneifolia* v.A.v.R.* var. *subglauca* v.A.v.R.*, with a trunk 4 m. tall and 13 cm. in diameter. In an earlier Fragment I mentioned that van Nouhuys, in a ravine on the south side of the mountain at an altitude of 3650 m., found a *Cyathea* with a trunk 3.5 m. high,[27] while the Kremer Expedition in 1921 brought photographs from the Upper Baliem Plateau (3300 m.) and from the approaches to Wilhelminatop (base 4100 m.), in which are seen a number of robust stunted plants which I take to be tree-ferns.

Among the shrubs and tree-shrubs in this ravine I also found a *Symplocos* (no. 1803), a widely branching shrub 3 m. tall, with white flowers, *Drimys pachyphylla* Diels*, likewise more robust than the specimens previously mentioned, *Styphelia nutans* J. J. Sm. var. *axillaris* J. J. Sm.*, about 1.5 m. tall, with pale yellow-green flowers, *Sericolea Lamii* O. C. Schm.* with white, and *Dimorphanthera parsifolia* J. J. Sm.* with dark red flowers, *Xanthomyrtus longicuspis* Diels (end.), with very noticeable golden-yellow flowers, and finally *Timonius avenis* Val.* (end.) and one of the Araliaceae (no. 1735). The only liana in this forest is one of the Araliaceae, perhaps a *Schefflera* (no. 1792), with dingy light purple flowers, the corolla dropping off unopened; the petioles and fruits showing the typical purple discoloration of mountain-plants. More or less scandent, sometimes epiphytic, is *Diplycosia Lamii* J. J. Sm.*; some other representatives of this family are epiphytes, such as *Rhododendron nummatum* J. J. Sm.*

The mossy covering forms a colorful layer under the trees, colorful particularly on account of the flowers protruding from it. Here is a pretty *Corysanthes* (no. 1779), a small plant with white stalk, white roots, and a bright purple flower above the single leaf. In addition there are species of *Glomera*, such as *G. acutipetala* J. J. Sm. and *G. Pullei* J. J. Sm., and many plants of the previously mentioned species of *Mediocalcar*, with its conspicuous red and violet-green color. Other Orchidaceae (nos. 1776–7, 1780) found at lower altitudes were also collected here. In addition to *Astelia alpina* R. Br., here growing in the

[27] v. Rosenstock, Nova Guinea VIII, 4 (1910), 716.

moss are many ferns and species of *Lycopodium*, as *L. clavatum* L. (all temperate zones and tropical subalpine territories) var. *tamariscispica* v.A.v.R., a light green plant creeping through and over the moss. Of the terrestrial ferns, I mention *Polypodium allocotum* v.A.v.R.*, *Dryopteris stereophylla* v.A.v.R.*, *Hymenophyllum Reinwardtii* v.d.B. (Java, Sumatra, Borneo, N. Guin.), and *Elaphoglossum sclerophyllum* v.A.v.R.*, in which the lower surface of the coriaceous fronds is entirely covered with a thick mass of brown sporangia. Only as epiphytes I observe *Polypodium subulatipinnum* v.A.v.R.*, *P. vernicosum* v.A.v.R*, of which the upper surface of the fronds appears as if varnished, another species of *Polypodium* (no. 1786), and *Pleopeltis gracilipes* v.A.v.R. On a boulder protruding from the moss *Pleopeltis cretifera* v.A.v.R.* grows. Finally I mention another epiphyte, *Hydnophytum crassicaule* Val.*, with a black tuberous stem.

The smaller ravines on the north side of the plateau are shallower and the vegetation on the floor is much less protected.[28] The forest does not grow to any considerable height. When one moves westward from Radio-bivak through the low shrubby forest in which the Dyaks had offered an egg-sacrifice, one descends somewhat to the half marshy bare muddy areas limited on the north by a beautiful small *Casuarina* forest and on the south by a low shrubby slope; in front is a small elevation with a border of *Casuarina* plants at the base, the slope being covered with Coniferae and *Drimys*. On the other side a slope, covered with scattered shrubs (among others undetermined, no. 1749), tall ferns (species of *Gleichenia* and *Lycopodium tomentosum* v.A.v.R.), and grasses, descends to a small ravine. On this slope I observed a young *Libocedrus* with a load of five heavy specimens of *Myrmecodia*, and the shrub *Polyosma longebracteolata* O. C. Schm.* The nearer one approaches the bottom of the ravine, the thicker the moss-layer becomes among the tall ferns, the more hygrophilous ones being hidden in the mossy covering. I found here *Trichomanes lasiophyllum* v.A.v.R.* and *T. compactum* v.A.v.R.* var. *pauperculum* v.A.v.R.*,[29] with fronds curving downwards, just as in *Hymenophyllum nutantifolium* v.A.v.R.* from Goenoeng Boetak (1420 m. alt.). Also concealed in the moss are a number of Orchidaceae, such as *Glomera fruticula* J. J. Sm., *Chitonanthera trigona* J. J. Sm., *C. obovata* J. J. Sm., and *Peristylus ciliolatus* J. J. Sm., all fragile plants frequently with very long stems, which seldom or never extend above the moss (also no. 1712). The species of *Glomera* have beautiful dark salmon-colored flowers; the finer ones of *Chitonanthera* show all variegations of orange. All these plants seem to be entirely adapted to the life within the moss-covering.

Below on this bushy slope is a place where the gray bare rock comes to the surface. On the side the perpendicular wall is green with mosses (such as *Campylopodium euphorocladium*, *Braunfelsia subulata*, *Bryum porphyreoneuron* var. *giganteum*, *Schlotheimia Lamii*, and no. 1715, the last two fiery red in color). The foot of the decline is surrounded by a growth of *Gleichenia subulata* v.A.v.R.*; in front of it lies a small gently sloping gravelly field.[30] This area is covered with a few dense clumps of a grass (no. 1682) having rolled spear-like blades and a few young plants of a very small *Dipteris* (*D. novo-guineensis* O.

[28] Vegetationsbilder XV, Pl. 29–31.
[29] This type occurred as an epiphyte at Goenoeng Boetak (1420 m.).
[30] Vegetationsbilder XV, Pl. 29A.

Posth.*);[31] it is further strewn with small pale rose fruiting bodies of a fungus (no. 1714) and of a lichen, *Baeomyces novoguinensis* Zahlbr.*, as well as with ♂ plants of a species of moss, *Dawsonia crispata;* the ♀ plants of this species grow close to the surface of the slope and have very large capsules.[32] Another fungus (no. 1739) occurs on dead wood. The narrow ravine-floor shows little new in the vegetation. Above on the margin, which descends steeply at this point, is the shrub-like *Alyxia Lamii* Markgr.* On the ground itself [33] various robust ferns grow, such as *Alsophila aeneifolia* v.A.v.R.* This plant is the type of the variety which was collected in the pontic ravine. In this much more open, small ravine the plant, less than 1 m. tall, grows on a tree-trunk 4 dm. in length. Another tree-fern is *Cyathea imbricata* v.A.v.R.*, which is 3 m. high (trunk 2 m.). Much smaller but nevertheless still robust is *Lomaria revoluta* v.A.v.R.,* attaining about the same size as the previously mentioned *Alsophila*. Here *Polypodium subpinnatifidum* v.A.v.R.* grows as an epiphyte. In some places the shrubs suddenly become dense; among them *Coprosma ulicoides* Val.* is particularly conspicuous with long thin branches leafy for long distances and protruding high above the rest of the vegetation. Here also is *Quintinia Schlechteriana* O. C. Schm.*, with pale green-yellow flowers, a *Litsea* (no. 1747), with yellow-green flowers, and *Sericolea Lamii* O. C. Schm.*, with white ones. A *Rubus* (no. 1585), with long flexible sharp prickly branches, twines through the shrubby growth, here and there adorned with its large white flowers.

We shall presently leave the Radio-plateau and follow the changes taking place in this flora at a still higher altitude. The trail used for the ascent to the summit carries us over bare stone ridges and through a few marshes to the foot of the enormous steep crumbling declivity (*Fig. 20, c*) cutting off the plateau on the west side. Along the foot are still a number of robust *Casuarina* plants, the branches covered with *Myrmecodia*.[34] The slope consists of a chaos of huge boulders with deep crevices between them exceeding the height of a man, thus forming a very irregular surface. The trail of trampled plants, of earth on bare rocks, of scratches of hobnailed shoes on the stones is difficult to follow but for the small flags—pieces of bandage-gauze tied to long stakes—which were placed at regular intervals. In the beginning the distinctive marks were very useful. Once lost among the boulders, one must frequently search a long time for the lost trail, as the crevices between the boulders were so deep that one had no view over the land. Eventually we knew each stone, each turn, each jump, and it became a sport to cover this mighty rugged slope in record time.

The flora here is very rich, a fact surely to be ascribed to the presence of the crevices, not only because these offer shelter against the worst extremes of the climate, but also because humus and plant-seeds collect therein as the rain-water runs off the rocks. For this reason the crevices have a more or less thick growth of shrubs. Strongly dominant here are *Vaccinium* (no. 1631), species

[31] In British New Guinea is another high montane form about 2 dm. high which, according to Seward, resembles the fossil species of *Hausmannia*, especially *H. crenata* Richter (of the Rhaetic period) more than the living species of *Dipteris*. Perhaps there is reason to relate this species, which is also found on Daymantop (Papua), to *Dipteris* (cf. Rec. Trav. Bot. Neerl. XXVa (1928), 244.

[32] Vegetationsbilder.

[33] Vegetationsbilder XV, Pl. 30–31.

[34] Vegetationsbilder XV, Pl. 41.

of *Rhododendron* such as *R. toxoides* J. J. Sm.*, *R. simulans* J. J. Sm.*, and *R. Lamii* J. J. Sm.*, and *Diplycosia Lamii* J. J. Sm.*; these also are most conspicuous because of the usually red flowers. In addition one observes *Styphelia Vannouhuysii* J. J. Sm., the *Eurya* (no. 1666) before-mentioned, with its stiff branches all obliquely directed upward in one plane, Myrtaceae such as *Decaspermum Lamii* Diels*, with yellow-white flowers and dark red fruits, closely related to *D. Lorentzii* Lauterb. from the south side of the mountain, and *D. prostratum* Diels* with pale cream-colored flowers; the last naturally occurs only in open places between the rocks, not in the crevices. Here too are a few species of *Evodia*, among others no. 1679 and *E. Doormani montis* Lauterb.*, a robust shrub with flowers wine-red outside and almost white within, and also the small *Haloragis fruticosa* F. W. Went*, with dark gray bark and dark red flowers. Other shrubs here are *Ternstroemia papuana* Lauterb.* (no. 1613), or a species very closely related to it, with pale yellow flowers and red fruits, *Polyosma longebracteolata* O. C. Schm.*, with curled leaf-margins, the flowers green within and brown-hairy outside (I found here a double flower among them), *Drimys* (no. 1630), and finally an undetermined shrub (no. 1627). Of the conifers I observed only *Phyllocladus* (no. 1628), and a poor specimen of *Casuarina* is practically the only plant which stands out above the profile of the slope. Among the woody plants I mention finally the parasitic *Henslowia acutata* Pilger*. The vegetative parts of this plant, like those of *Exocarpus*, show all colors from green-yellow to red, and its long thin stems grow as thick and tangled over the host as, for example, *Cassytha* on the shore, or *Cuscuta* on the Dutch heath. In contrast to the Loranthaceae, the two previously mentioned parasites, the santalaceous *Henslowia* and *Exocarpus*, fasten themselves on the host at only one spot. The small flowers and fruits are a beautiful warm dark red.

The herbs here are relatively few. In small flat places or in shallow crevices are clumps of the beautiful *Gahnia* (no. 1748). Among the mosses on the margins of the small shrub-forests grow *Chitonanthera obovata* J. J. Sm. and *Glomera Pullei* J. J. Sm. Here and in more open places are a few other Orchidaceae, such as *Calanthe Versteegii* J. J. Sm. (end.), with green-white flowers, and particularly the beautiful *Dendrobium vexillarius* J. J. Sm. var. *purpureo-viride* J. J. Sm. Higher up, the last becomes more common and is immediately noticed because of its flowers. Each plant has a pair of erect flowers turned toward each other, with the perianth-segments more or less spread in one level; they are very large and of a peculiar color: very dark green with all shades to lighter green and green-white.

Above us the slope suddenly becomes much more easily passable; the second plateau is reached. Large flat rocks, small level patches of white sand, or earth, dark-colored because of the presence of humus, offer an easy path over this narrow saddle which, between two small elevations, leads to an indentation of the plateau. Before us lies this widely undulating and forsaken world of rocks; the brown color of the rock-formation dominates in the distance; but at close range the eye is captivated by the lilac *Patersonia*, the yellow Myrtaceae, the rose and cream-colored *Styphelia*, and the fiery red Ericaceae; *Nepenthes Vieillardii* Hook. f., with its green and red pitchers and its brown flower-clusters, contributes to the picturesqueness of the small alpine gardens. The trail leads through an indentation (*Fig. 20, t*) wherein immediately again the shrubs extend to the height of a man. Then it ascends again as a muddy track

clearly recognizable upon the rocks lying along the naked slope. When we have climbed this trail the real summit (*Fig. 20, e*) lies open before us, on the opposite side of a steep ravine sloping towards the north (*Fig. 20, k*).

Here the path carries us through a richly flowering forest of low trees with small evergreen leaves, and some distance further through a small group of tall and slender *Casuarinae*. *Nepenthes* is exceedingly common here on the bare spots among flat stones. And, although we do not find a number of plants which occur on Radio-plateau, it is not only impoverishment which changes the floral picture. Thus here is the thin elegant *Rhododendron extrorsum* J. J. Sm.*, with light gray branches, very few small leaves, and large wide-open light citron-yellow flowers. The large *Myrmecodia* is exclusively terrestrial. Apparently we are now above the range of the greatest frequency of this species, the number of plants being smaller as well as the measurements of each individual.

A high grassy saddle (*Fig. 20, m*) forms the link between the two parts of the summit; here is the indentation which is seen from the plain. Among the tall clumps of grass (no. 2027) and Cyperaceae such as *Schoenus* (no. 1691) on rain-washed earth, a small *Viola* (no. 1673) grows; I had found a few scattered specimens of it at lower altitudes; the plant is not more than 4–5 cm. tall, with purple-striped white flowers and firm thick leaves. In the small streamlets which in some places flow over fine white sand, in others over stones covered with thick layers of waving algae, I found a peculiar grass (no. 2029) which forms small hard shaggy convex clumps not more than 4–5 cm. in diameter and 2–2.5 cm. high, growing in the water or on the margin of it; the short stiff leaves are sharp and the inflorescences of but one or two flowers scarcely protrude above them. A small liverwort-like plant also grows here at the side of the water.

In the small alpine gardens, *Henslowia acutata* Pilg.* is still very common; also I observed here one very small specimen of *Exocarpus Pullei* Pilg.*, a single stem a few decimeters tall, parasitic on the roots of a shrub. The few phylloclades were thickly beset with galls.

The tallest tree-like plants are *Casuarina* and *Phyllocladus* (no. 1647), in a small group at about 3500 m. altitude (where the path cuts the slope, cf. *Fig. 20*); these trees are 2 to 3 m. tall. In that small forest are also *Drimys fistulosa* Diels* and a few Ericaceae, all about 1.5 m. high. The ground is covered with a thick moss-layer, and on the branches of the trees hang thick bunches particularly of red mosses, such as *Schlotheimia pilicalyx*, *S. MacGregorii*, *Thysanomitrium MacGregorii*, and no. 2034. In more open alpine gardens on the slope and particularly in small hollows, where a thick moss-layer covers everything, a number of smaller shrubs grow, such as *Styphelia trilocularis* J. J. Sm. var. *quinquelocularis* J. J. Sm., *Evodia Doormani montis* Lauterb.*, and a few Ericaceae such as *Rhododendron simulans* J. J. Sm.* and *Vaccinium molle* J. J. Sm. Herbs are not at all scarce on this terrain. *Euphrasia* and three species of *Didiscus*, *D.* aff. *saniculifolius* Stapf (no. 1659) and two others (nos. 1645, 1692, 1694), occur here. One (no. 1645) is a somewhat xeromorphic small plant about 1 dm. tall, with the basal rosette of thick small leaves dark green above and purple beneath; the petioles and peduncles are often purplish, the umbels with flowers purplish outside, white within. One readily observes that young parts protected from the light do not become purple; from this, it might be deduced that the ability to develop this color is present definitely in the imma-

ture flowers. In the moss-covering I collected a fern (no. 2028), and on a rock *Polypodium trichocarpum* v.A.v.R.*, a species observed at 2540 m. altitude. The number of Orchidaceae here is still large. *Mediocalcar crenulatum* J. J. Sm., with its deep red and green color, the light green *Calanthe Versteegii* J. J. Sm., and the large-flowered dark and light green *Dendrobium vexillarius* J. J. Sm. var. *purpureo-viride* J. J. Sm. grow here in undiminished numbers and undiminished splendor. The last-named species in the floral parts is likewise strongly inclined to purple coloring under the influence of light. Should this fact have been considered sufficient reason to establish a variety, it will have to be reduced. The large *Myrmecodia* occurs here but is continually less in number and smaller in size. However, on mossy places the gray *Hydnophytum* and *Nepenthes* are still common.

The ravine (*Fig. 20, k*) on the east side of the highest peak slopes very steeply toward the north and is more continuously filled with shrub-groups. The saddle, however, is devoid of all shrubs. Unexpected and surprising is the scene which unfolds before him who climbs a few scores of meters higher to the margin of the long narrow ridge sloping from Doormantop toward the southeast. Before he arrives at the top, already a cutting wind blows in his face, and a little later he stands on the margin of an enormous precipice which continues from the southwest side of the summit some distance toward the west. As the relatively regular and broad terrain rises on the north side to the outline of the dominating Doormantop in the distance, so abruptly it falls on the south side many hundreds of meters, bare, crumbling, and loose, with a slope of 60° to 70° continuing unbroken 600 to 700 m., to where the tall forest with its rounded tree-crowns covers the ridges. There below lie the rolling mountain slopes of the Swart Valley in the luxuriant beauty of green forests and succulent meadows under a mild sun. And thereafter crest after crest rises to the very horizon, where the Central Chain cuts off the field of vision at a distance of 80 km., and where, small but clear, the perpetual snow-field of Wilhelminatop glistens in the sunlight.

Before closing this Fragment, we shall once more cast a glance over this impressive world of unspoiled beauty from the point at which one may enjoy an uninterrupted view, Doormantop itself. And I shall finish this floristic survey with a short sketch of the flora of that point, one of the highest in the extensive surroundings. The fact that this open greatly exposed summit still has a very large number of taller plants reminds us that we have not yet, at this altitude, nearly reached the vegetation-limit in a region so close to the equator as this. On the small plateau of the summit itself a low shrub-flora grows, which, however, does not rise above the edges of the protecting clefts. Among them we find three red-flowered Ericaceae, *Rhododendron toxoides* J. J. Sm.*, *R. gaultheriifolium* J. J. Sm.*, and *Vaccinium ciliatipetalum* J. J. Sm.*; in addition the thymelaeaceous *Drapetes ericoides* Hook. f., with very light cream-colored flowers, *Styphelia Dekockii* J. J. Sm., with rose flowers, the large-flowered *Oldenlandia coprosmoidea* Val.*, with lilac campanulate flowers, a firm-leaved compact *Cynoglossum* (no. 1658), *Decaspermum Lamii* Diels, and the creeping *Xanthomyrtus Klossii* Diels var. *brevipedunculata* Diels*. *Nepenthes Vieillardii* Hook. f. is still common here, likewise *Euphrasia* (no. 1644), *Gentiana singgalangensis* Back. (no. 1660), *Cladium* (no. 1667), and two Orchidaceae, *Microtatorchis terrestris* J. J. Sm. and *M. Lamii* J. J. Sm., with at first light green flowers which later become yellow or yellow-orange. Finally

here is a species of grass (no. 1664), showing a strong purple color in all parts exposed to light. This highest plateau has therefore 15 or 16 species of higher plants, of which eight are shrubs; 16 species of the perhaps 8000 to 10,000 native to New Guinea are suited to this habitat and thrive on the mountain-top. On all sides below lie zones continually richer in species, and as soon as one descends somewhat from the highest point, this richness of species increases at once, because the stands are partly sheltered. Immediately one observes shrubs 1–1.5 m. high. I find the light yellow *Rhododendron extrorsum* J. J. Sm., *Evodia Doormani montis* Lauterb.*, *Styphelia Dekockii* J. J. Sm., *Drimys fistulosa* Diels*, *Henslowia acutata* Pilg.*, *Phyllocladus* (no. 1647), and so many other species of shrubs and herbs which I have already mentioned above.

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A few ecologically important observations must be associated with this floristic survey.

In the third Fragment I have mentioned in passing why Schimper's xerophytic theory cannot be accepted. However, at present we cannot offer any substitute explanation in its place which is as satisfactory as that proposed by Schimper and, from the following brief observations, one may conclude from the *choc des opinions* that the truth has not yet been discovered.

Senn,[35] whom I have already quoted a few times, comes to the following conclusion in his article on the physiology of alpine and other plants: "So dürfen wir die Mehrzahl der Alpenpflanzen jedenfalls nicht zu den Trockenpflanzen oder Xerophyten zählen. Ihre bisher als xerophil aufgefassten morphologisch-anatomischen Charaktere sind keine ökologischen Anpassungen, sondern notwendige Folgen der niederen Temperatur und der hohen Lichtintensität; diese Faktoren sind es, und nicht die Trockenheit, welche ihre Wachstums- und Gestaltungsvorgänge bedingen." And rightly Blagowestschensky[36] says at the end of his paper: "Zu einer richtigen Lösung des Problems sogenannter Schutzvorrichtungen, des Xeromorphismus und der Pflanzentypen gegebener Standorte bedarf es einer weiteren Ansammlung von Tatsachen aus dem Gebiet der vergleichenden Pflanzenphysiologie, da die Ansiedlung der Gëwachse hauptsächlich durch innere Faktoren bestimmt wird." Indeed, we must not look for an explanation of the adaptation of mountain-plants in the field of morphology or of anatomy, but rather in that of physiology. Not in the first place, as Schimper believed; but I still think we must be on guard and not go to the other extreme of denying all influences of outward conditions on form and structure. I believe that it is possible to indicate a number of morphological peculiarities, even be they of secondary nature, which can be explained satisfactorily in no other way, but their importance is surely not primary. Therefore, one should not go further than to say that a certain xeromorphy can be determined in some mountain-plants, but one can conclude that plants in exposed situations are for the most part not hygrophytes in any case. For a number of plants the visible quantity of water is small; in addition the low temperature works strongly as a limiting factor even though sufficient water be present, as, for example, in the case of plants which root in mosscushions and which are exposed in part to temporarily strong dehydration

[35] G. Senn, Verh. d. Schweiz. Naturf. Ges. (1922), II, 154.

[36] W. Blagowestschensky, Der osmotische Wert bei den Gebirgspflanzen Mittel-Asiens—Jahrb. f. Wiss. Bot. LXV (1926), 279.

(radiation and wind). Also, resistance against great temperature-changes must be present, and, although the plant resists these influences principally through physiological adaptation, the outward form and the inner structure have not remained uninfluenced.

In another place in the above-quoted article Senn says: "Da jedoch das Klima in bedeutenden Höhen über dem Meeresspiegel in allen Erdteilen die charakteristischen Merkmale unseres Alpenklimas aufweist, werden sich vermutlich auch die Pflanzen anderer Hochländer durch ähnliche physiologische Eigentümlichkeiten auszeichnen wie diejenige der Alpen, wenigstens da, wo wie bei uns, die Niederschläge reichlich bemessen sind." It must be admitted that this assertion contains much truth, but I still believe that one must use foresight in establishing analogies between plants of temperate and of tropical mountains. Previously, errors have been made in the field of plant-geography through the application of the laws known to apply to temperate floras, without further research on their application to that of the tropical mountains; such remarks as the one mentioned above show that one could take the same road in the ecological-physiological field. Apart from the fact that an altitude of 3000–3500 m. in an equatorial region is not comparable with that in the Alps, where Senn experimented (namely, 2450 m., i. e. 300 m. above tree-limit, which lies at about 3800–4000 m. in the tropics), seasonal changes in temperate regions clearly provide a point of difference which is very important. The winter there has a strongly limiting influence on the summer-flora. In addition, the range between high and low temperatures in the tropics is quite different (cf. Fragment II, Table I).

A short discussion of what more recent researches have indicated in this field must here find a place. Senn found that alpine individuals of a species not only can withdraw more water from the earth than those of the lowland, but also that they can transpire more strongly independent of light-intensity, at least in a temperature lower than 6° C.[37] On the other hand, experiments have proved that alpine plants in drought remain turgid longer than lowland plants under—*mutatis mutandis*—similar circumstances. This can be the result of the ability thereby either to inhibit strong evaporation or to transfer water more quickly, and also by less water-content of the soil, or possibly of both. I shall herewith point out that this is truly an adaptation in a xerophytic direction, and when it can be demonstrated that the stopping of evaporation—be it only in part—is made possible through the peculiarity of form or structure (and therefore not only through the closing of the stomata), then one would be able to speak certainly of more or less xeromorphy in such a case. In this connection I shall therefore recall that, with reference to this question, the gist of the xerophytic theory also is touched. One thinks only of so many xerophytic epiphytes and desert plants, in which the water-accommodation is the entire governing factor, and it becomes important to examine in such plants, or in truth in such matters, the "bisher als xerophil aufgefassten morphologisch-anatomischen Charaktere"; indeed correlations by younger authors show the indicated physiological adaptation. Besides Senn, Maximov[38] has demonstrated, for steppe-plants, that those plants in drier places have a stronger water-transportation, a stronger transpiration, and a higher root-pressure.

[37] Again a temperature at the indicated altitude which in the tropics is encountered only very temporarily and locally.

[38] N. A. Maximov, Physiologisch-ökologische Untersuchungen über die Dürreresistenz der Xerophyten. Jahrb. f. Wiss. Bot. LXII (1923), 128.

Turesson [39] has therefore rightly pointed out the difficulty: that all these experiments were done not with hereditary units, but with populations. He therefore experimented with pure lines of alpine and arctic plants and found that there exist hereditary differences between ecotypes of the same species. He demonstrated that alpine plants have a much lower plasmolysis-limit and therefore lower osmotic pressure in the roots than lowland forms, so that the stronger osmotic suction-force unquestionably shown in alpine plants can be induced only as a modification, for example by temperature and light, and therefore is not hereditary. In themselves, therefore, alpine plants can be considered to be much less able to utilize the available water than lowland plants, and a hereditary strong suction-force of the roots is an adaptation of the utmost importance for mountain-plants. Turesson also refuted the opinion of Blagowestschensky that each systematic species would have its own osmotic pressure, although the critic admits that the osmotic pressure in some species is extraordinarily constant, whereas in others it can vary within certain limits. He notes too that xeromorphy and high osmotic pressure need not occur together. I believe, however, that Turesson's opinion that the higher suction-force of alpine plants would be induced by light and temperature requires further confirmation. According to my idea, the question is whether one must not think rather of a direct, or, if need be, an indirect influence of evaporation; such apparently is the case in steppe-plants. Even if Senn demonstrated, by comparative evidence from alpine and lowland plants, that the first sometimes possess a more intensive water-transport, I shall still maintain that the progress of many other life-processes has no other significance than that the optimum for alpine plants is much lower than for plants of the lowland, similarly, as we shall see, with relation to the discoloration of flowers. This related in particular to carbon dioxide assimilation and transpiration.

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I have inserted these theoretical considerations first, to call attention to the doubt and uncertainty which exists at present in this field of plant-geography, and second, to mention some of the modern ideas regarding the solution of the problems by quoting some of the recent authors. We shall now return to Doormantop and consecutively subject the various ecological factors of this high mountain-territory to a brief consideration.

From table I of Fragment II one sees that the observed minimum temperature on Radio-plateau (under the shade of a pent-house 0.5 m. above the ground) amounted to 8.4° C. Lower temperatures, however, doubtless occur near the earth, as witnessed by the hoarfrost which was seen a few times at sunrise after a clear night.

The observed minimum relative condition of humidity amounted to 51%, mostly, however, values between 80 and 100% were obtained. On high summits in Java much lower minima (6%) have been observed.[40]

That the light here is very intense is evident, among other reasons, from the shorter exposure-time necessary in photography. A short time ago Denis Mulder, in an interesting article,[41] has shown that the ultraviolet rays increase

[39] Göte Turesson, Untersuchungen über Grenzplasmolyse- und Saugkraftwerte in verschiedenen ökotypen derselben Art.—Jahrb. f. Wiss. Bot. LXVI (1927), 723.

[40] See F. C. von Faber, Die Kraterpflanzen Javas in physiologisch-oecologischer Beziehung —Arbeiten aus dem Treub-Laboratorium I (1927), 29, fig. 4.

[41] Handelingen 4de Ned. Indisch Natuurwetenschappelijk Congres, Weltevreden, 1926, p. 151.

both quantitatively and qualitatively with increasing altitude, whereas the ultrared heat-rays decrease in the same measure. The ultraviolet rays are most important, not only for the photographic plate, but also for living things, and one may accept that they particularly form the active agent in the retarding influence of light on the growth in length. Among the plants recorded I have mentioned beautiful examples of this. Species of *Gentiana*, *Didiscus*, *Glomera*, and *Chitonanthera* grow as tall as their surrounding or shading flora as well as in the shade of shrubs, and therefore reach an unusual length, whereas on open land they remain unusually small. Proportional differences of more than twelve to one were noted in this connection. This influence of light prevails in much stronger measure for the vegetative than for the floral parts. In a specimen of *Gentiana* (no. 1623) growing in a shaded habitat, I found the relative length of the plant to be 12.5 times the diameter of the flower, while in a specimen growing on open ground the relation was 3.3. The length of the plant in the latter instance was 2/15 of that of the former. The diameter of the flower was reduced one-half. Doubtless herein we may find the explanation for the previously mentioned fact that the relative size of the flower increases with the altitude. As a nice example I earlier listed the different species of the genus *Argostemma* (*A. nanum* K. Schum.—*A. Lamii* Val.—*A. montis Doormanni* Val.) which succeed each other in the different altitudinal zones of the slope; each has relatively (and perhaps absolutely) larger flowers than the preceding one. It would be worth while to consider whether, when mountain-species are transferred to lower levels, their flowers also would become relatively smaller.

Another phenomenon, which must be attributed to the influence of light, is the formation of purple (red) coloring matter (anthocyanin), mentioned above as occurring in exposed plant-parts. I have noticed similar discolorations in some grasses (no. 1664), *Dendrobium vexillarius* J. J. Sm., *Gentiana*, *Didiscus*, *Decaspermum prostratum* Diels, *Euphrasia* (only the vegetative parts), and some species of *Drimys*. With respect to this matter I have observed, particularly in *Gentiana*, that the parts which have been covered by others—as parts of the corolla by the calyx-lobes—remain practically white not only in naturally white flowers, but also in the cobalt-blue ones of the gentian. The critical period in the formation of anthocyanin is very early in the development of the part; the color appears only in the young exposed parts, while in parts at first almost covered, but later exposed to light, this is not the case. Not only the flowers but also the vegetative parts are sensitive to the formation of anthocyanin, though in a lesser degree, and this can develop so far that the whole plant becomes more or less purple. I could also note that individuals of some species near the highest point of the summit (3500 m.) clearly possessed more purple color than those of Radio-plateau (3330 m.), and that near Uitzicht-bivak (3120 m.) in a number of species the coloring matter was entirely lacking, whereas higher up these species were definitely colored. According to Bouget,[42] the discoloration in flowers at greater altitudes is the rule, always tending to violet. The optimum for different species, however, may vary greatly; for some it is found at low altitudes, these frequently becoming white-flowered at higher altitudes, while others exhibit their strongest color-form at high altitudes. The classic work on this subject is that of Bonnier.[43] It

[42] J. Bouget, Observations sur l'optimum d'altitude pour la coloration des fleurs—Compt. Rend. Acad. Sciences Paris CLXXIV (1922), 1723.

[43] G. Bonnier, Ann. Sci. Nat. Bot. XX (1895), 217.

is also discussed in an article of Weisse,[44] which gives a summary of the literature which has been published on color-variation of flowers under the influence of external conditions. Some see in the presence of this coloring matter—also in young leaves—a protection against high temperatures through radiation, at least as far as it concerns the vegetative parts, since the red color does not absorb the red heat rays. Others [45] deny this, and think the development of anthocyanin is a direct result of the allied processes of carbonic acid assimilation. Perhaps therefore the explanation of alpine coloring must be explained otherwise, since we have seen that the heat-rays are much weaker than the ultraviolet ones. Possibly the occurrence of strongly shining leaves in some shrubs and even ferns (*Pleopeltis vernicosum* v.A.v.R.) is a defense-medium against too strong light-rays.

An adaptation against the drying-out effects of the wind is the presence of very thick fleshy scales on young buds, and in addition these buds are usually surrounded by the erect youngest leaves. The most general phenomena pointing in the same direction are: leaves closely pressed against the stem pointing upward (*Drimys*, *Eurya*, *Styphelia*, *Rhododendron*) and often rolled up (*Drimys fistulosa* Diels, grasses, *Gleichenia vulcanica* Bl.) or folded together (*Cladium*, *Patersonia*); the plants on exposed places do not grow outside of the crevices; others form cushions (grasses, *Schoenus*, a few Rubiaceae, also *Gahnia* to a lesser extent); some possess hairy leaves or fronds (*Rubus*, *Gleichenia vulcanica* Bl. var. *plumosa* v.A.v.R., *Potentilla*, *Lycopodium tomentosum* v.A.v.R.); while a number of herbs have water-storing tissue (*Euphrasia*, *Gentiana*, *Viola*, *Didiscus*, *Myrmecodia*, *Hydnophytum*, many Orchidaceae). This last-named category is still the most xeromorphic, but it is at once clear that most of these are not xerophytes; moreover, a number of plants which sometimes may be found xeromorphic can thrive as mesophytes (perhaps even be hygrophytic) and in another place also can live as true xerophytes. A mountain-peak, such as this, is not a habitat where we must expect real xerophytes, for in the first place xerophytic life is adapted to dryness, and there is no question of that here. True, there may be a few hours each day when a very strong wind may produce great atmospheric dryness; but almost everywhere there is enough water in the soil so that only a slight adaptation is sufficient to help the plant through these hours. And the temperature is not low enough so that one can speak of a strong "physiological drought."

The fact that the leaves of almost all shrubs here are firm (though often brittle)—which earlier was considered as a xerophytic adaptation—seems to me more a response to the strong wind (strengthened mechanical tissue).

I have already mentioned that a large number of true hygrophytes occur here. First there are the plants living entirely within the moss-cushions, such as *Trichomanes compactum* v.A.v.R., *T. lasiophyllum* v.A.v.R., and a few species of *Glomera* and *Chitonanthera*. The moss itself, which absorbs the capillary water, naturally belongs to this group. In protected places we find even tall-growing hygrophytes, such as a species of *Homalanthus* and tree-ferns, which I encountered in the pontic ravine.

Finally I should like to point out a fact which I have been unable to explain: the frequency of either light gray or black as the color of the bark of most shrubs (not to be confused with the same colors caused by lichens).

In recapitulation I supply here the accompanying ecological table:

[44] A. Weisse, Verh. Bot. Ver. Prov. Brandenb. LXV (1923), 31.
[45] Cf. G. L. Funke, Ann. du Jard. Bot. Buitenzorg, XL (1929), 52.

	Favorable factors	Unfavorable factors			
	Much water and high relative humidity	Strong radiation		Low temperature (strong radiation)	Strong wind [1]
Physical results	Slight evaporation	Local and short periods of high temperature	Strong evaporation	Low average temperature in ground and moss-cushions (= 10° C.)	Strong evaporation, locally low temperature
Physiological results in view of: *a.* Water-transport	Little transpiration of absorbed water or none	Easy absorption of water from the soil		Difficult absorption of water from the soil [2]	Transpiration of much absorbed water
b. CO_2 Assimilation	Strong transpiration (stomata open)	Strong		Retarded (delayed) [2]	Retarded
c. Growth			Retarded	Retarded [2]	Retarded, plants restricted to crevices
d. Tendril-movement		Nyctitropism (and positive thermotropy?)			
e. Transpiration	Strong (stomata open)			Optimum prevention at low temperature	Slight (stomata closed)
Adaptations	Thin tissues, little mechanical tissue; many leaves		Shining leaves		Small thick leaves with much mechanical tissue and/or water-tissue; few leaves; leaves compact, rolled, folded together, or hairy; fleshy bud-scales; cushion-shape
		Purple coloring of flowers and vegetative parts			
			Few small hard thick leaves; small-sized plants; strong root-pressure; strong resistance to withering; strong transpiration		

[1] Gentle trade-winds; the local winds of short duration, preceding a rain, are here dominant.

[2] Here it is observed that a number of plants perhaps take the optimum for these processes, just as is apparent for transpiration, at relatively low temperatures.

This survey is far from complete; for instance, here are lacking the physiological factors of seasonal influence, temperature changes, slope, atmospheric pressure, etc., the action of all of which is still less completely known than is the case with the factors discussed above. It is therefore another indication of our insufficient knowledge of this interesting field of plant-geography, and possibly will be a stimulation for others to study these problems further.

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The classification of my collection at the moment does not permit dealing amply with the problems of genetical plant-geography, to which the flora of a high mountain-summit such as Doormantop should give the opportunity. In expectation of a later study, I must therefore limit myself to a few general observations.

Above the forest-limit I collected 304 numbers. Of these 18 are algae, six lichens, 31 mosses, three fungi, 26 ferns, and nine lycopods—altogether 93 cryptogams. In the remaining 211, four numbers are still undetermined as to the family. The whole can be divided as follows:

Indeterminatae		4
Cryptogams		93
Gymnosperms: Coniferae		9
Angiosperms		
Monocotyledons:		
Orchidaceae	54	
Gramineae	8	
Cyperaceae	5	
Liliaceae	2	
Iridaceae	1	
Pandanaceae	1	
	71	71
Dicotyledons:		
Ericaceae	29	
Rubiaceae	15	
Myrtaceae	9	
Epacridaceae	8	
Magnoliaceae	7	
Umbelliferae	6	
Apocynaceae	4	
Compositae	4	
Gentianaceae	4	
Rutaceae	4	
Santalaceae	4	
Saxifragaceae	4	
Elaeocarpaceae	3	
Rosaceae	3	
Symplocaceae	3	
Ternstroemiaceae	3	
Araliaceae	2	
Boraginaceae	2	
Casuarinaceae	2	
Nepenthaceae	2	
Scrophulariaceae	2	
Aquifoliaceae	1	
Euphorbiaceae	1	
Goodeniaceae	1	
Haloragaceae	1	
Lauraceae	1	
Thymelaeaceae	1	
Violaceae	1	
	127	127
		304

While we may suppose that the number of species is divided about proportionally in the major groups, then the Coniferae would be 4.4% of the Phanerogams (the real numbers show a much larger representation), the Monocotyledons 34.3%, and the Dicotyledons 61.3%.

For a long time, apparently under Wallace's influence, the idea was accepted that New Guinea was a land that was populated on the one hand from the Asiatic continent and on the other from Australia. The idea was so fascinating that one scarcely thought of the possibility of a native fauna and flora, at least in part. The result was that one spoke almost exclusively of the Asiatic and Australian forms when specimens of the New Guinean fauna and flora were received for examination.

Even if New Guinea in its modern form is still young in geological terms, in such a gigantic country one may expect without doubt a certain and probably an important amount of independence. I think that Schlechter [46] was the first to suggest (in connection with the Orchidaceae) that New Guinea itself has been and still is a center of development and distribution. Moreover, many genera, which earlier passed for Australian, can with more right be counted as belonging to the native flora of New Guinea. In a lesser degree, this is also the case with a number of Asiatic (Malaysian) and Polynesian forms. As an example of this Schlechter mentioned the genus *Corysanthes*, of which at present New Guinea has the largest number of species.

Ridley,[47] under whose guidance the botanical collections of the Wollaston Expedition were organized, and Miss Gibbs,[48] who has investigated the plant-geography of a high mountain of New Guinea in detail, both agree with this opinion. On good grounds the latter vindicates the position that the island is the center of distribution for many other plant-groups besides the Orchidaceae. Her most forcible arguments are (1) the richness in species, (2) the great differentiation of forms, and in particular (3) the wide distribution of endemic high mountain-plants. As examples of the first two she names *Libocedrus*, *Drimys*, and *Myrtus*, whereas *Pandanus*, *Freycinetia*, *Rhododendron*, *Vaccinium*, and *Styphelia* show a richness of forms exceeded in few other regions. Instances of the wide distribution of mountain-plants, on the basis of my collection at present, cannot be given, although I shall indicate here species of *Gahnia*, *Riedelia*, *Didiscus*, *Gentiana*, *Dacrydium*, *Styphelia*, *Rhododendron*, and *Vaccinium*, and a number of Orchidaceae such as *Dendrobium Vannouhuysii*, etc. Meanwhile, we may consider that the flora of Doormantop will furnish new arguments in favor of Miss Gibbs' position. Rightly she points out that *Didiscus* positively is an example of the original and relatively ancient period of the New Guinean flora; the oldest type occurs here and toward the west, the younger to the east and south.

Therefore, coming to the conclusions to be drawn from my collections, I shall once more point out that, lacking determinations at this time, it is possible to make only a few definite statements. Sometime I hope to have the opportunity to write more accurately on this subject. Provisionally I should like to treat the flora of Doormantop as composed of the following elements: (1) endemic species and genera with New Guinea as a probable center of develop-

[46] R. Schlechter, Die Orchidaceen von Deutsch Neu-Guinea (1911–1914), I, 14, XX.

[47] H. N. Ridley, Report on the Botany of the Wollaston Expedition to Dutch New Guinea—Trans. Linn. Soc. London, II, Bot. IX, 1 (1916), 9.

[48] L. S. Gibbs, A Contribution to the Phytogeography and Flora of the Arfak Mountains, &c. (London, Taylor & Francis, July 1917), 39–49.

ment and distribution; (2) species of Asiatic origin or relationships; (3) species of Polynesian origin or relationships; (4) species of Australian origin or relationships; (5) species known only on high mountain-peaks, frequently far remote from each other.

I intend to include the following plants [49] in these different groups:

I. Endemic genera or genera with New Guinea as the probable center of distribution, or at least with a strong differentiation there.

1. *Libocedrus*—circum-Pacific, particularly New Guinea.
2. *Chitonanthera*—endemic.
3. *Corysanthes*—particularly New Guinea, also Australia, some species in the western part of the Archipelago.
4. *Glomera*—tropical Asia, Polynesia, America, strongly developed in New Guinea.
5. *Mediocalcar*—New Guinea, also Amboina.
6. *Microtatorchis*—New Guinea, New Caledonia, and Fiji.
7. *Octarrhena*—endemic.
8. *Pedilochilus*—endemic.
9. *Phreatia*—particularly New Guinea, westward to Asia, eastward to Polynesia.
10. *Riedelia*—particularly New Guinea, also some species westward.
11. *Didiscus*—particularly New Guinea, some species also in the west, in Australia and in Polynesia.
12. *Dimorphanthera*—about 30 species in New Guinea, one in Amboina, and two in the Philippines.
13. *Sericolea*—endemic.
14. *Xanthomyrtus*—endemic. [Philippine Islands, Borneo]

II. Species and genera with western (northern) relationships (see also V for * species and genera).

*1. *Gleichenia vulcanica* Bl.—Archipelago.
*2. *Lycopodium complanatum* L.—Northern hemisphere and tropical alpine regions.
3. *Libocedrus*—circum-Pacific.
4. *Podocarpus*—Eastern Asia, Africa.
5. *Peristylus*—Madagascar, Abyssinia to New Guinea.
6. *Acronychia*—Asia—Polynesia.
7. *Alyxia*—Archipelago.
*8. *Cynoglossum*—Northern hemisphere.
9. *Decaspermum*—Archipelago.
*10. *Drapetes ericoides* Hook. f.—New Guinea, North Borneo.
11. *Elaeocarpus*—Archipelago.
12. *Eurya*—East Asia.
13. *Evodia*—Asia (the New Guinean species, however, perhaps related to eastern species?).
*14. *Gentiana*—Northern hemisphere.
15. *Henslowia*—Archipelago.
16. *Homalanthus*—Archipelago.
17. *Hydnophytum*—Asia—Polynesia.
18. *Ilex*—Northern hemisphere.
19. *Litsea*—Archipelago.
20. *Myrmecodia*—Asia—Polynesia.

[49] For this the following literature is used:

Engler & Gilg, Syllabus d. Pflanzenfamilien, 7th ed. (1912).
L. S. Gibbs, l. c. (Phytogeography of the Arfak Mountains).
————, Notes on the Phytogeography and Flora of the Mountain Summit Plateaux of Tasmania—Journ. of Ecology VIII (1920), 1, 90.
E. D. Merrill, A bibliographic Enumeration of Bornean Plants—Journ. Roy. As. Soc. Str. Branch, Spec. Number, Sept. 1921.
————, Enumeration of Philippine Flowering Plants, I–IV (1923–26), particularly part IV, pp. 77–105 (Floristic relationships of the Philippines).
H. N. Ridley, Report on the Botany of the Wollaston Expedition, etc.—Trans. Linn. Soc. London, II, Bot. IX, 1 (1916).

21. *Polyosma*—Archipelago.
*22. *Potentilla*—Northern hemisphere.
*23. *Rhododendron*—Northern hemisphere and tropical alpine region.
24. *Rubus*—Northern hemisphere.
25. *Syzygium*—Asia.
26. *Ternstroemia*—Eastern Asia.
27. *Timonius*—Asia—Polynesia.
*28. *Vaccinium*—Northern hemisphere and tropical alpine regions.
*29. *Viola*—Northern hemisphere.

III. Species and genera with eastern relationships.

1. *Glomera*—Asia, New Guinea, Polynesia, America.
2. *Microtatorchis*—New Guinea, New Caledonia, Fiji.
3. *Casuarina*—Archipelago, New Guinea, Australia, New Caledonia.
4. *Mearnsia*—One Philippine species, one in New Guinea, and one in New Caledonia.
5. *Nepenthes Vieillardii* Hook. f.—New Guinea, New Caledonia.
6 *Quintinia*—Philippines (one species), Australia, New Zealand, New Caledonia.

IV. Species and genera with southern relationships (see also V for * species and genera).

*1. *Lycopodium scariosum* Forst.—Mindanao, Australia, New Zealand.
2. *Dacrydium*—Tasmania and New Zealand, also a few in the western part of the Archipelago.
3. *Libocedrus*—circum-Pacific.
4. *Phyllocladus*—Tasmania, New Zealand, one species in North Borneo and Luzon.
*5. *Astelia alpina* R. Br.—Australia.
6. *Cladium*—Particularly Australia, eight species westward to the Philippines.
7. *Corysanthes*—Australia, some species extending to the western Archipelago.
*8. *Gahnia*—Southern hemisphere, some species in the Archipelago (*G. psittacorum* Lab.: Australia, Tasmania).
*9. *Patersonia*—Australia, some species extending to North Borneo.
10. *Schoenus*—Particularly Australia, four species westward to the Philippines.
11. *Casuarina*—Archipelago, Australia, New Caledonia.
*12. *Coprosma*—Australia, New Guinea, North Borneo.
*13. *Didiscus*—New Guinea, Australia, one species in Mindoro and North Borneo.
*14. *Drapetes*—Australia, west to Kinabalu (Borneo) (*D. ericoides* Hook. f.).
*15. *Drimys*—Australia, South America, one North Borneo-Luzon species.
*16. *Euphrasia*—(related to *E. borneensis* Stapf of North Borneo and Luzon and to species from New Zealand).
17. *Exocarpus*—14 species in Australia and Polynesia, some extending into the Western Archipelago and the Philippines.
18. *Haloragis*—60 species in Australia, some west to southeast Asia and Japan.
19. *Quintinia*—15 species: New Guinea—Australia—New Zealand—New Caledonia, one Philippine species.
20. *Scaevola*—Australia.
21. *Styphelia*—240 species in Australia, New Zealand, New Caledonia, six species in the Archipelago.

V. Species and genera of high mountain peaks.

The following plants already named in II and IV and indicated by an asterisk are known especially from high mountain-summits, which frequently are far apart.

1. *Gleichenia vulcanica* Bl.
2. *Lycopodium complanatum* L.
3. *Lycopodium scariosum* Forst.
4. *Astelia alpina* R. Br.
5. *Gahnia*
6. *Patersonia*
7. *Coprosma*
8. *Cynoglossum*
9. *Didiscus* (*saniculifolius* Stapf)
10. *Drapetes ericoides* Hook. f.
11. *Drimys*
12. *Euphrasia*
13. *Gentiana*
14. *Potentilla*
15. *Rhododendron*
16. *Vaccinium*
17. *Viola*

It has been long known that the "islands" of alpine flora in the Archipelago have species nearly related to or even identical with species of northern regions, for example, from the Himalaya Mountains, and scientists have tried to find an explanation for this. A very early theory, apparently originating after the analogy of glacial relics, was that the glacial periods could have given such plants opportunity to transfer themselves via the lower lying regions from one mountain-peak to the other. Wegener [50] and others have, however, made apparent that the drift in this part of the tropics has been only of lesser significance. Later the influence of the trade-winds over high mountain-summits was considered. Miss Gibbs [51] has pointed out the relationship between the flora of high Mount Kinabalu in North Borneo and that of mountain-plateaus of Tasmania with the flora of high mountains in New Guinea; and Merrill [52] has noted that a number of species on Kinabalu also occur on high summits in the Philippines. In her publication on the Arfak Mountains (l.c. p. 46), Miss Gibbs has focused attention on the possibility of wind-transport of objects, much heavier than most seeds, over great distances, while in her article on Tasmania (l. c. p. 104) she mentions a report by Griffith Taylor [53] on meteorological conditions in the Archipelago investigated in the interests of an air-service between Asia and Australia. In two illustrative diagrams, Taylor very clearly presents the dominant upper and lower winds in January and July and indicates that, above 3000 m. altitude, a strong polar wind blows over New Guinea the whole year; it also blows above Melbourne at 1200 m. altitude and apparently extends over the South Pole to South America. Miss Gibbs thinks that the connection between these and the occurrence of some plants (*Drimys*, *Libocedrus*, *Glomera*, *Styphelia*) in both Australia and South America is not necessarily problematical; whereas, it is very possible that plants (*Rhododendron*, *Vaccinium*, *Gentiana*, *Potentilla*, *Rubus*, *Euphrasia*) may be transported from the Himalaya Mountains via isolated peaks in the Archipelago toward New Guinea and Australia by the northwest monsoon,[54] and then by the continuous wind mentioned above. Nevertheless, the wind must blow likewise in a westerly and northerly direction—and then apparently lower—as witness the occurrence in New Guinea of the Australian *Astelia alpina* R. Br., of the New Caledonian *Nepenthes Vieillardii* Hook. f., and particularly note the New Guinean species which also occur on Kinabalu and in the Philippines (*Drapetes*, *Drimys*, *Didiscus*), and still farther to the west are species of *Haloragis*, *Exocarpus*, *Styphelia*, *Corysanthes*, *Quintinia*, *Dacrydium*, *Phyllocladus*, *Patersonia*, and *Scaevola*. This does not mean that all plants are spread by the wind. For a number of species genetic phytogeographical factors must be considered,

[50] A. Wegener, Die Entstehung der Kontinente und Ozeane, 3rd ed. (1922), 86—See also Irmscher, Pflanzenverbreitung und Entwicklung der Kontinente—Mitt. a. d. Inst. für Allgem. Botanik in Hamburg, V. (1922), 29.

[51] L. S. Gibbs, A Contribution to the Flora and Plant Formations of Mount Kinabalu and the Highlands of British North Borneo—Journ. Linn. Soc. Bot. XLII, no. 285 (1914), 1—See also Id. Phytogeogr. Tasmania, l. c., and O. Stapf, On the Flora of Mount Kinabalu in North Borneo—Trans. Linn. Soc. Bot. II, IV (1893), 69.

[52] E. D. Merrill, Enumeration of Philippine Flowering Plants, IV (1926).

[53] Air Routes to Australia—Geogr. Review VII (1919), 259, figs. 1–3.

[54] According to C. Braak (Het Klimaat van Nederlandsch-Indië, I, 1923–25, p. 75), easterly winds blow above Batavia from May to October at all levels from 1000 to 7000 m. altitude. In November these still blow above 2000 m., whereas below that height westerly winds prevail. From December to April westerly winds blow up to an altitude of 4000 to 6000 m., and above that easterly ones prevail.

as, for example, *Nepenthes Vieillardii* Hook. f. Danser [55] is of the opinion that this species originated apparently before New Caledonia was separated from New Guinea. The most primitive forms of the genus occur in India (proper) and a general direction of distribution must be accepted from west to east.

In these considerations I make some provisional assertions on which it may be possible to build later. I should like to draw attention for a moment to the possibility of distribution by powerful cyclones which sometimes arise between North Australia and the southeast part of the Archipelago, and also between the Philippines and the continent of Asia.[56] If this communication proves to be an inducement to initiate the study of plant-geography in the Archipelago, I shall think its aim is largely accomplished. Up to now this important branch of science has been the subject of research by few. It is understandable that, although the zoögeography of the Archipelago has been studied more than 75 years, the much less surveyable field of plant-geography began to be developed only a very short time ago; nevertheless, I believe that the time has come and that there is at present a sufficient amount of material to test the results of geology and zoögeography by possible conclusions drawn from the dispersal and the mutual relationships of plants.

I shall close this discussion with a quotation from Miss Gibbs' article on Tasmania: [57]

"The mountains of New Guinea, therefore, on the strength of both geological and meteorological data, may be considered as the focus of development and distribution of the so-called 'antarctic' plants, justifying the term Papuan austral-montane for this group, of which, even on the limited basis of our present knowledge, nearly one-half of its most characteristic genera are now known from New Guinea. This number will increase in proportion as further work on the vast and barely known ranges of that country add to the little knowledge we possess of their plant covering between the tree and the perpetual snow levels."

* *
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The days spent at Radio-bivak (October 16–29, November 14–17, 29, 1920) belong without doubt to the happiest of my life. October 18, the day the vanguard started towards Swart Valley, I remained behind in company with the radio Lieutenant, a European corporal-signaller of the Marines, our boys, my native helpers, and a Javanese sergeant with some fusileers and convicts.

In the early morning our first walk was to the south margin of the plateau, from which we could observe the Central Mountain Range, and each morning that view was different. Sometimes the majestic landscape lay before us almost cloudless, the sharply toothed ridge 80 km. distant traced on the far horizon against a cold clear sky, in the midst of which is the small white gleaming perpetual snow-field of Wilhelmina-top; then again parts of the parallel mountain-ridges lay concealed below an extensive shining white cloud-cover, through which Wilhelmina-top made its appearance covered with freshly fallen powdery snow extending far down the slopes from the highest point. Sometimes a soft blue clear winter sky, with a yellow mist on the horizon,

[55] D. H. Danser, The Nepenthaceae of the Netherlands Indies—Bull. Jard. Bot. Buitenz., III, IX (1928), 425.

[56] C. Braak, l. c., 118, 127. E. D. Merrill, Enumeration, etc., l. c. IV, 15.

[57] l. c., 106.

appeared out of the darkness of the night; then again a massive clear stratus stood out high above all mountains; the ridges lay shadowless and gray one behind the other, the finest serrations of the Central Chain being outlined clearer than otherwise against the smooth gray of the clouds.

The 3820 m. summit so near us displayed various moods. In the morning, after enjoying a cup of hot coffee as we started off shivering and shuddering to see Wilhelmina-top, it stood against the still pale light of the rising sun as a powerful black screen with fantastic margins on the eastern heaven, threatening as a phantom because of its still unknown details. At noon, it towered frequently hundreds, yes even thousands of meters above the vast mass of clouds, which from the plain pushed their long woolly tongues into the mountain-ravines. It seemed lower and friendlier to us when showing itself in its finest details; in the light of the low western sun it lay before us in all its glory of color, sometimes sharply outlined against the threatening darker background of a rainfall far in the distance.

The Meervlakte, too, our third great attractive view, came before our eyes in an endless variety of color and light effects. In the morning, when the central highlands were mostly clear, the wide plain lay covered with low clouds, but in the afternoon after a rain, before sunset it was frequently visible, just when the view to the south was mostly obstructed. The outlook over this enormous valley made an even more majestic and powerful impression than the view over the mountain-ridges to the south. Sometimes we stood a long time speechless, on a projecting boulder, staring at the wonderful play of lights over the plain, over the mountain-ridges which shut off the horizon toward the north, and particularly at the magnificent cloud-scene above. Then the plain was entirely clear except for a few small bright white cloud-streaks, after which it quickly disappeared. Rivers and lakes before us were all definitely outlined and reflected glaring white the summits of the enormous alto-cumulus and cumulo-stratus [clouds] lighted by the sun. Many towered above the Gauttier and the van Rees Mountains, one next to the other, from east to west over a distance of hundreds of kilometers. The enormous cloud-piles in all colors of sharp white to yellow, orange, and red, changing to the gray shadow of rain beneath it, produced an effective scene not only because of the colors but also because of the incessant flashes of forked lightning extending through the clouds.

But the days were not always so pleasant. Sometimes a biting wind and falling rain forced us to return to our low hut surrounded by a meter-thick layer of branches, covered with a three fold layer of canvas, where we lay on a thick floor of elastic branches under the covers. After the shivering morning walk a scanty breakfast followed. Scanty, since the upward transport began to falter; once, out of 32 tins of rice assigned to the carriers at Prauwen-bivak, only three were delivered; they had eaten the rest in transit as rations due them. Very soon the result was a shortage of food for the vanguard, and an untimely break in the exploration of the valley could be prevented only by the timely sending below of all men not strictly necessary. How I was a victim of this circumstance is briefly recorded in Fragment I.

However, the usual clear sunny morning hours were spent in collecting and making notes. During this time the Lieutenant organized the affairs of the bivouac and made himself very useful by installing, with very primitive tools, a

simple radio-apparatus which, although too weak to send out reports, enabled us to receive a very important communication and to pass it on to the valley.

But when the mist began to settle and shortly thereafter the rain began to fall, I emerged now from a ravine, then again from the summit, lured by warm coffee or chocolate which I knew was prepared. These, with the morning coffee, were really the only happy moments as far as the culinary situation was concerned. After dinner, differing somewhat from breakfast and supper only in quantity, I dove into the mantri's quarters to take care of my collections of the morning, while the rain tapped on the canvas and the wind whistled around the hut. The tea-hour sometimes brought good weather and a short walk, and the evening after supper was spent in developing, in a kneeling position, a few dozen photographic plates in ice-cold water, or lying down and writing diaries and notes. But then, while the candle-lantern cast flickeringly fantastic shadows in the dusky corners of our cold cave, we pulled our blankets over our ears—we usually slept fully clothed and sometimes with a cap on—and fell asleep surrounded by an endless silence, accentuated by a few monotonous sounds. Everywhere the little frogs, which spent the day in the gray plants of *Hydnophytum pauper* Val., croaked shrilly, making one think of the warbling of a swallow which we heard during the day. This swallow, an ousel-like bird,[58] and a single mountain-duck, the only larger bird occurring here, probably with *koeskoes* (*Phalanger*), and possibly still an opossum, are about the only representatives of animal-life here. And when it neither rained nor blew, the thick drip trickled from the moss-cushions on the branches of the old *Casuarina* tree onto the canvas over our heads.

Naturally the view from Doormantop was in general similar to that from Radio-plateau, at least towards the north, east, and south. Towards the west and southwest, however, one has, in addition, an outlook over the course of the Swart River; furthermore, the impression of the view from there is still more powerful because of the unhampered range of vision, comprising 360°, and because of the high position in a barren world of naked rocks, sloping on all sides and in every direction into massive fixed rock-bays down to the darker forest. Already Radio-bivak lies far in the distance, somewhat lower and very insignificant: a small spot of canvas shining in the sun, and a very small smoke-plume.

The broad Swart Valley lies directly west, separated from the plain only by a mountain-chain, and near Doormantop bending towards the south. A descent into the Dika Valley, the ravine of a mountain-stream joining the main stream at the bend, appears almost impossible. It seems hardly practicable at all to attain the level of this small undulating cloudy forested ridge below, the softly arching lines of which extend downward toward the inhabited valleys, separated from the ridge of our summit by an exceptionally steep and high wall. There

[58] This bird was particularly tame. In the lower mountain stretches also, I repeatedly had the opportunity to observe the tameness of small mountain-birds, which agrees well with what Buytendijk (Psychologie der Dieren, Uitg. Volksuniversiteitsbibl. no. 3, 1920, p. 105) writes: "At first birds in uninhabited islands and in newly discovered lands show no fear of man." Notwithstanding the noise that a climbing European makes on a difficult slope, small birds frequently remained sitting without any fear, even if one came so close that they could be grasped with the hand. Once I surprised a forest-fowl family of cock, hen, and half-grown chickens, which were quite undisturbed in their busy search for food, even when I tried to get into the midst of the little flock to observe more closely what they were doing.

lie the sunny unforested slopes below us. On these slopes opposite us—by air-line only 8 km. distant—are the enclosed fields of the Timorini, distinguishable to the naked eye only as small sections; but field-glasses reveal in addition the presence of small round dwellings, while everywhere fires in fields being cleared are visible. On the other side of the Swart River a mighty unforested slope extends gradually upward to about 3600 m. This view is almost like a vision of Paradise.

The next and last Fragment will contain some data on the landscape, flora, and people of these valleys.

VII. Land and people of the Dika and Toli Valleys [1]

On November 17, 1920, I set off on a three-day trip to the sunny valleys inhabited by the very recently discovered Timorini.[2] In doing so I made use of the last Dyak transport about to proceed to the vanguard in the Swart Valley, before the return of the van Overeem Expedition should begin. In another Fragment, I noted that the shortage of food a few weeks before had forced me and my assistants to leave Radio-bivak and to return to Goenoeng Boetak. Subsequently, through measures taken in the meantime, conditions had grown less alarming, and I, with one of my assistants—the other having been sent back to Prauwen-bivak—my boy, and three Dyaks, had been able to work some days longer in the vicinity of Beek-bivak. In the nick of time I heard, from a downward transport, of the plans to return. Since I did not wish to deprive myself of the opportunity to get acquainted with the recently discovered natives and their culture, I hastened once more to Radio-bivak. Unfortunately, on account of the insufficiency of food, I had to send my second mantri back. It was impossible to transport the heavy zinc tins, and for collecting purposes I had to content myself with 30 glass tubes and a notebook.

Fig. 22. Outlook from Doormantop toward the west and southwest; — — — = visible, and ..... = not visible part of the route followed; 1 = Mos-bivak; 2 = Dika-bivak. .

As indicated earlier, the trail from Radio-bivak to the Swart Valley lies over Doormantop. The western slope is steep and difficult. Beyond this we come to a long ridge running toward the west and joining a western peak. Toward the north the slope is at first gradual, and then it quickly becomes steeper; to the south it drops precipitously; for hundreds of meters the bare debris continues (*Fig. 22*). This steep incline is entirely inaccessible without climbing aids. We follow the margin for a long time, thereby enjoying a wider outlook in both directions.

At 3100 m. the forest gradually begins. The bare rocky slope, broken below by a few small marshes, changes little by little into a terrain with here and there groups of shrubs. Somewhat farther away these scattered groups increase in size until they finally merge and form a thin forest, consisting almost wholly of *Casuarina* and a few Coniferae, particularly *Dacrydium*.

[1] Natuurk. Tijdschr. Nederl.-Ind. 89: 291–380. 1929.

[2] In some older articles on the expedition the name "Oeringgoep" is used. Later on it became evident that "Timorini" is a better name for this part of the mountain-folk.

Meanwhile the mists had closed in around us. While I was traversing this thin forest, the mist becoming thicker, I suddenly heard a weak but clear whistling behind me. I looked around just in time to see a rather large bird, apparently a mountain-duck, fly by, each stroke of its wings producing the whistling noise.

At half-past ten, through increasingly thicker vegetation, we reach a point where the slope to the south is less precipitous than formerly, and a descent is possible. This is the place where the vanguard spent the first night, Mosbivak (Fragment I, Map B, no. 13). Now the entire vicinity was concealed in the mist. Later from this point we had a clear outlook over the valley so well known to us then.

A decline of 600 m. along a mossy slope dripping with water and covered with a thin forest lies before us. The track is very steep but neither difficult nor perilous. It is a fortunate circumstance that the trail is still undisturbed and therefore many small trunks and roots are unbroken. Shortly after the beginning of the descent we cross a narrow but high and still very recent deposit of debris. Next we slide from tree to tree part way along the slope, at every step passing wet tree-roots and moss-cushions soaked with water, to the next marshy place. Thus we proceed for several hours, a seemingly endless trip. Toward noon we pause for a short rest on a level place, where it is evident that the Dyaks have rested previously. At this point I see the first *Pandanus* plants, which begin here as suddenly as they disappear on the north side. Judging from the length of elapsed time in the descent, we can, with reasonable certainty, estimate the altitude of this place at 2600 m. Here also *Gentiana singgalangensis* Backer grows at the lower limit of its range. The vegetation-type of the forest below this location is very noteworthy. The forests, ever higher and thicker, are light green from the overwhelming mass of fine bamboo which, with many *Pandanus* plants, completely dominates the undergrowth. It impressed me as representing the same species which I encountered so many times on the north side of the mountain at 2700 m. Apart from that, the other floral-types are comparable to those on the ridge toward Doormantop. The difference is still more striking in the neighborhood of Bamboe-bivak (2450 m., Fragment I, Map B, no. 14), where the steep slope ends abruptly. After crossing a beautiful mountain-brook, we arrive there at half-past twelve. Rain threatens, but before it falls I examine the region to obtain an impression regarding the above-mentioned differences. The overwhelming quantity of ferns, which there make up almost the entire undergrowth, is lacking here. The undergrowth of this forest is chiefly of higher plants, among which the Urticaceae occupy a much more important place than on the north side, where the family is very rarely represented at this altitude; on the other hand, here particularly few Ericaceae are seen. With the statement of these facts, I cannot refrain from recalling again what Pulle [3] writes with relation to the flora of the south slope of the Central Mountain Range. In the mountain-stretches there appear to be two types of primary forest, one with Urticaceae as ground-covering on limestone, and one with Ericaceae especially in the mossy forest on sandstone. The difference is so striking that one would almost doubt the justice of the geological assertion that this entire ridge still consists of basic eruptive rock and that sedimentary rock begins only to the north side of the Dika layer.

[3] Maatsch. t. Bevorder. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 68 (1913), 35.

Also I was beginning to have some doubts concerning the explanation of the mossy covering, of which I have already spoken.[4]

In a few minutes I collected nine species unknown to me; among these were three Urticaceae (nos. 2040–2), that is to say, an epiphyte, an herb, and a shrub, also a scandent *Piper* (no. 2038), of which genus a number of species occur here. Along the stream I found *Scutellaria luzonica* Rolfe (no. 2039; Phil.) or a closely related species, in addition a *Rubus* (no. 2037), and a beautiful and terrestrial club-moss with reddish brown stems, *Lycopodium rubricaule* v.A.v.R., also found by Pulle at the same altitude on the south side of the mountain. The forest in this vicinity is still somewhat open but now the trees are robust and tall; the bamboo grows in great quantity only on the steep slopes; apparently it needs considerable light. On the more moderate slopes near the camp are many conifers. I thought I recognized *Araucaria* (on the north side I was never able to determine this genus with certainty), *Dacrydium*, and *Podocarpus* among the tallest trees; *Phyllocladus* is a common shrub in the undergrowth. In addition the undergrowth is very rich in *Pandanus* plants of all sizes, and for that reason the forest is difficult to traverse.

While I orient myself, one carrier comes in after another, several hours elapsing between the arrival of the first and the last on account of the difficult traveling. Meanwhile at 2 o'clock the rain commences to fall, thus hindering bivouac-making considerably. The Dyaks, however, show an unusual almost unsuspected cordiality and are very attentive; a friendly act, the purpose of which I first realized the following day. The entire afternoon they are merry and clamorous; they take turns begging for empty tins, clothing, and shoes or trying to induce me to promise these at the end of the expedition. It rains heavily all afternoon while a violent thunderstorm rages about us. The previously quiet and clear brook has become a wild dirty brown torrent which, with thundering force and alarming power, rushes down behind the camp. But toward dark the rain begins to lessen, and everywhere around us we hear the sound of the drip from the moss-cushions mingling with the well-known noise of the whistling frog, possibly the same species that lives above in the *Hydnophytum*. I do not see the plant here but perhaps it is epiphytic in the crowns of trees.

The morning of the 18th is clear and still. It is remarkable how much milder the climate here suddenly becomes in comparison with that of the exposed northern slope; this place is sheltered by a great cliff on the north side and subject to the influence of the deep open sunny valleys to the south. At 6:30 A.M. I proceed in advance of the Dyaks. The path, although little traveled, is rather poor. Felled trunks have not all been removed; rattans are not entirely cut. It is a beautiful forest, with constantly changing views and also much that is new to the botanical world. Now the trail descends steeply for 50 m. then again extends for some distance along the slope. The slender bamboo is still present everywhere but dominant only in few places. The undergrowth is rich in shrubs and small trees; the number of ferns is still strikingly few. An hour after my departure I reach the first stopping-place of the Dyaks, recognizable by the places where they sit. Here the Dyaks catch up with me. They show an unusual desire to let me go ahead, and so at nine o'clock, at the head of the procession, I arrive at the ample Jachthut-bivak (Fragment I, Map B, no. 15). The forest here, at about 1900 m. altitude, is

[4] See Fragment V, and Pulle l. c. 33.

tall and thin on gently undulating ground. In passing the camp, after we have forded a mountain-creek flowing from the east, the vegetation-picture varies considerably; the number of bamboos increases again, but this is now a species with stems a few centimeters in diameter. In this vicinity I still found a young *Cupressus*-like coniferous plant (no. 2164). Also increasingly more ferns are found here in the undergrowth, including many which I had observed on the north slope. This is also the case with a number of higher plants, such as *Argostemma* and *Balanophora*. Moreover, the undergrowth here is much less difficult to traverse, owing to the presence of fewer *Pandanus* plants, and the level parts of the ridge are covered with a beautiful open forest. At 1850 m. elevation, I see the first specimens of a peculiar melastomataceous plant (no. 1533) and a few orchids previously observed elsewhere. Twenty minutes after leaving Jachthut-bivak, we reach the hunter's hut from which it takes its name. This stands on an open place, evidently an old landslip now covered with a vegetation composed of grasses intermingled with *Dianella* plants with blue and white flowers. The forest-margin is colored by a broad strip of tall *Melastoma* (*M. malabathricum* L.?, no. 2046) plants in full flower, and a patch of a robust red-flowered *Impatiens*, strongly suggesting the common *I. platypetala* Lindl., occurs in a marsh developed along the bank of a small stream. I collected the clinging *Nephrolepis humatoides* v.A.v.R. on the trunks in the forest-margin.

In the middle of this small open area stands the hunter's hut, the first sign of the large Papuan tribe in the interior. It appears to have been recently constructed. Possibly the Timorini sometimes come here to hunt pigs, cassowaries, opossums, porcupine-anteaters, and various kinds of birds. The hut consists of only a roof of palm-leaves and grasses. The floor is covered by small poles. I stand here a long time examining and touching the rough notches in the wood, which reveal the work of a stone axe. So strongly does this hut suggest the proximity of natives that I almost expect to see a group of Papuans appear from the forest-margin. How the vanguard may have felt on reaching this point, with the immediate future uncertain, is not known![5]

The Dyaks sit together on the grassy slope. At the sight of the shabby hut, their hilarity is completely silenced and they say with emphasis: "roemah papoe, toean dokton," a Papuan hut, Sir. Then they invite me by word and above all by gestures not to wait for them but by all means to proceed. They would not be so impolite as to go ahead of me (although earlier they were always anxious to do this). I then leave the brave fellows quietly behind and proceed alone, convinced that they will quickly follow. The path continues through miry places and across brooks. The underlying rock is still of the eruptive type. The bivouac where we will pass the night lies at about 1700 m. altitude near one of the streams. We named this the Second Parkieten-bivak (Fragment I, Map B, no. 17), because at night we heard the same harsh noise of the parakeets (perhaps even the same species, *Chalcopsittacus duivenbodii*, observed earlier) quickly flying over. For the same reason the First Parkieten-bivak, situated at the same altitude on the other side of the mountain, was so named. At 10:15 A. M. I make camp, and immediately after my arrival the Dyaks appear with innocent-looking faces. The rest of the morning is spent in bathing and in examining the surroundings. Unfortunately, however, not

[5] See Bijlmer, Tijdschr. Kon. Ned. Aardrijksk. Gen. XXXIX (1922), 170, and De Aarde en haar Volken LIX (1923), 170 (sep. 39).

much collecting can be done. Here, at the lower limits of its distribution, on the highest branches of a tree, is a plant of the large *Myrmecodia*, which at the summit grows on the ground. Also here is the tallest of the *niboeng* palms, *Kentia*, which was so well-known to us on the north side, particularly because of its delicious palm-cabbage. I further recognize various ferns, a couple of climbing species of *Elatostema*, a *Podocarpus*, and in addition a scandent melastomataceous plant with white flowers and orange-red fruits, which reminds me of Goenoeng Boetak.

In the afternoon there is a short but heavy shower. The Dyaks are still in a noisy frame of mind. They talk very noticeably about the Papuans; and they introduce into their conversation all the Malayan phrases that they know in order that I too can understand what they say. Under cover of a joke, though with an anxiety which they can hardly conceal, they prepare me to face the fact that the Timorini are a dangerous people. With this conversation I recall the vague and distorted rumors concerning the pig-incident which happened in the Dika-bivak. There the Dyaks had clandestinely stolen a pig from the natives and had butchered it. This offence against custom was cleverly exploited by the Timorini who, after much clamor and exaggerated boasting, were pacified by being presented with several chopping-knives. The following morning the puzzle of the Dyaks' friendliness was solved. At other times there was always much movement and hubbub when the first rays of the sun began to appear above the horizon, but now most of my comrades are very quiet at dawn. All are busy cooking rice, taking their time, but of preparation for departure not a word is said. A fairly sarcastic talk with Anji Nau, the leader of the group, intrigues the others, and it now becomes clear to me that their unusual behavior is caused by fear. I had least expected this. I had known the Dyaks as spirited and intrepid oarsmen. They knew the Timorini from previous experience; but I did not know then that the Dyak, in the face of hostile people, is timorous and is accustomed to destroy his enemies by assassination. Therefore, when they anticipated this procedure from others, it was conceivable that, on this day, they were actually afraid of these peaceable mountain-natives.

It appears that they can be persuaded to proceed with no other argument than my own departure. Nevertheless I grant myself the pleasure of firmly ordering Anji Nau to lead; I shall follow. But as they begin again to exhaust themselves by deep and repeated bows, I have enough of the theme and silently proceed in front. Meanwhile, I do not feel entirely at ease. I did not know of the timorous characteristic of the Dyaks; I knew of their courageous attitude on swift rivers; they knew the Timorini and I did not, and also I did not know how to evaluate the pig-incident fairly. With my revolver ready, I thus precede the group which was armed with spears and with shields made from oil-tins, because I cannot imagine that the fear of my companions and the precautions taken are baseless. Later, when I became acquainted with our good-natured friends in the Swart Valley, how I laughed over this incident!

The journey begins with an unexpectedly long ascent. The forest on the ridge is again open and traversable; the undergrowth is thin, but as we once more descend, we find ourselves suddenly surrounded by masses of bamboo and increasingly more ferns. From 1400 m. downward I saw *Dipteris conjugata* Reinw. and *Oleandra cuspidata* Bl. in profusion. At these same elevations there are suddenly more Urticaceae, particularly *Elatostema;* perhaps the sedimen-

tary rock-formation begins here. The undergrowth becomes continually more luxuriant and more dense; in it are giant Zingiberaceae with their obliquely standing stems surely 10 m. long, and a species of bamboo which does not form clumps, the 2–3 cm. thick stems being scattered through the shrubs.

The Dyaks stop on a narrow ridge. They treat me now as a valuable and indispensable being and think I must act as guide through this easy terrain. During the rest, contrary to habit, they remain standing; they encourage each other in boisterous ways and brandish their spears with warlike gestures, and although I do not understand what they say, I frequently catch the word "papoe" (Papuan).

As we continue, the warmth of the valleys greets us, a delightful sensation after all the wet and cold which we have encountered. The sounds of the birds from the warmer regions also affect us pleasantly. At 1400 m. we hear the first parrot screech, and a hundred meters lower the calls of the first birds of paradise. Here the flora is more luxuriant than any I saw on the north slope. A mountain-stream which we cross at 1250 m. altitude is decorated on the banks with broad margins of colorful *Impatiens* and *Spathoglottis* with tall stems. A little later we pass a landslip and, through the opening that it made, we see nearby on the other side of the valley a small settlement with natives going to and fro. After that we enter the forest and a moment later locate a Papuan path, which was already known to me from the report of the leader.

Entirely occupied with the many new things awaiting me, I was not conscious that this path, this sign of native culture on the outermost margin of their territory, would induce my Dyaks to lose the rest of their courage; and when, a hundred meters farther on, I reached a sunny open clearing, I was . . . entirely alone! The clearing was abandoned, the single house therein closed, a silent witness of Papuan activity on the edge of a well-shaded banana-plantation. When I had assembled my brave companions—they stood close together by the last bend in the path, still deep in the forest, waiting, the foremost man trying to save face by fashioning a piece of wood with a small knife—we continued, now through cleared secondary forest. For the first time we hear the sound of the Dika on the left. Later we cross an open grass-field at the side of which a low shed is built over a series of beehive-like objects constructed of *Selaginella* fronds. According to Wirz (l. c. 54, fig. 9, 10) these miniature houses are erected for the benefit of the souls of the departed (*koegi*). Next is a descent over a very steep and narrow ridge, on both flanks covered with thin and young forest and on both sides hemmed in by thundering mountain-torrents. To the left the white foaming Dika roars in its channel; on the right a stream with abundant water plunges down in a high waterfall. This is the same stream which we crossed at 1250 m. altitude. Instantly I could very well imagine the suspense felt by the vanguard, who, on October 23, 1920, descended this same path without the certainty that this mountain-torrent could be crossed and without any knowledge as to how they would be greeted in their first contact with the natives. At the foot of the waterfall lies a level spit with gravelly shores at the bottom of the chasm, luxuriantly covered with vegetation. Growing together here are some plants of the beautiful coniferous *Callitris robusta* R. Br. (no. 2166; Austr.), a small tree with very fine pendent foliage which at once reminds one of a *tjemara* (*Casuarina equisetifolia* Forst.). Immediately after this, the trail extends towards the left and we stand before a bridge (*Fig. 23*). It is a beautiful place. The Dika, a wild raging river with

much water, is visible only for a relatively short distance, and the cliffs rise so sheerly that the slopes above cannot be seen. Without doubt this is one of the few places where the river is crossed; and indeed it was by a great good chance that the vanguard chose this ridge and thus came to the bridge. On the other side is a bridgehead constructed of poles. From that, the bridge slants upward to the top of a cliff four or five meters above the water, where it is fastened to a couple of trees, the roots of which provide the necessary support. The trail is reached on the other side by climbing the slope. At the arrival of the vanguard, the Dyaks, who in such cases always know the way out and in addition have a great disdain for all that is not Dyak, established a

FIG. 23. Timorinese suspension bridge over the Dika River (somewhat schematic).

secondary bridge adjacent to the existing one by skillfully felling a notched tree-trunk across the river. But this bridge was not adaptable to Europeans wearing boots, and so we used the Timorinese bridge which, although it appeared to be somewhat unsteady, was reinforced with rattan. This masterpiece of Timorinese technique was, singularly enough, made of slender trunks, lianas, and roots. In its original construction no rattan was used; nevertheless, rattan of excellent quality is present in the forest in almost unlimited quantities. Possibly the working of this plant with the stone axe was too onerous; but with the rather ample use of the split rattan, the structure was strengthened. Be that as it may, the suspension-bridge belongs to the type which one finds mentioned for other regions,[6] and the cross-section of it shows a V-form. At the north bridgehead the supporting lines pass through the forked end of the outermost erect and strongest stakes, and are fastened to trees on the bank. The other stakes are cut off at 1.5 m. above the ground, and here is the beginning of the V-form structure. The supporting lines, i. e. the rails, carry a series of V-forms, thus forming the sides. The floor consists of two long slender trunks thrust into the rising bank and resting on the bridgehead, their more slender

[6] Cf. Verslag v. d. Militaire Exploratie van Nederl. Nieuw-Guinee, 1907–1915, pl. 46 and 47, and the sketch opposite p. 198.

ends reaching part-way across the river. Near the center of the span they are paralleled with and tied to the thin ends of two trunks extending from the other bank. The structure is 15 to 20 m. long.

Even before we arrived at this place, we had already noticed that people must have been there a short time before but apparently had hastily fled at our approach. Here and there the earth was somewhat disturbed and pieces of sugar-cane lay ready for planting, while other pieces were already planted. The Dyaks, who, when they see water, forget even their fear, have cast off their loads and their *tjawats* [native dress] and are bathing in the cool clear mountain-water. Meanwhile, as I stand looking at this pleasant scene, all at once I hear above the roar of the water, weakly but clearly, a strange long drawn-out call, and looking up, I see a few dark figures above the rocks on the other side of the bridge. As they see me looking they call again and make reassuring gestures. But they are evidently nervous and appear to be trying to find out what our attitude is. I shout back immediately and beckon to them. These good-natured and inoffensive primitive men at once cross the bridge. In front walks a small full-bearded man, a younger one follows after him, then a woman with a long carrying net supported from the forehead, and finally a blind old man who feels his way over the narrow wobbly bridge cautiously groping with his stick but in the main confident. With slow, sure, almost elegant steps, the first man arrives, although somewhat hesitating in his movements and with a nervous twitching of his face, but still looking fixedly at me, this new and unknown white man. So I have a quiet opportunity to take stock of him and to recall another impression which the first sight of the Boromesso and Takoetamesso, at Pionier-bivak, made on me. There a band of brutes, wild, more bush-animal than man, bold, and in every respect uncivilized; here, gentle friendly fellow-man, primitive as the first, but not without the inward refinement of a quiet and established citizen. He is slender but well built and very dark. His face, with its friendly although still somewhat fearful smile, is completely encircled with a curly beard. On his head is a greasy hair-net which hangs to the shoulders, such as adorns the mature men of the Timorini. On his right shoulder rests a stone axe, on his left a carrying net with its daily supply of food and other small possessions. With quiet dignified movement he approaches, and his bearing unconsciously conveys the impression of a certain national pride, a sense of being the proprietor of this land, in short, in contrast to us the host. But when he is near he again becomes somewhat afraid and, blinking his eyes, he walks straight to me across the bridge. During the whole period occupied in crossing the river, he has continually called to me with various reassuring-sounding words. The modulation of his voice somewhat compensates me for its unintelligibility, and in the talk that follows—held in a circle of already relieved, now again confident, crowding Dyaks—we understand each other in a certain sense very well. If there were any further salutation necessary for understanding hosts to offer, in order to make guests feel entirely welcome, then that salutation would surely be given. As I approach, he speaks to me with outstretched hand. We exchange a firm handshake in the European manner and I listen to his warm guttural sounds, which I answer with eloquently modulated Dutch or Malay. Nevertheless, with all his self-control, it is clear that he frankly would like to end the conversation, and, somewhat relieved, with a friendly smile he points above to where his work waits. He gives me a friendly pat on the arm and leaves, after I, in similar

fashion, have made clear to him that I shall proceed to the other side of the bridge and towards the camp. Quietly he disappears without looking back, his hands behind his back, followed by the youth, and then by the woman who, bent under the load on her back—in which load in a separate net sits a very young child—somewhat shy and tense, glances quickly at us as she passes. Finally comes the tottering gray-haired old man, whom age has made indifferent to new impressions, and, with the appearance of someone awaiting nothing more from this world, he kindly receives my handshake. And Anji Nau thinks he owes it to himself and to his status as Dyak head-man and number two of the group, to take up his position next to me and, with a certain "savoir vivre" and condescending friendliness, likewise to shake hands with the two men.

Such was then my first meeting with the inhabitants of this distant interior of New Guinea. I shall communicate some further details concerning them in the following pages.

In the meantime the Dyaks, having bathed, are preparing to continue the journey. Now all earlier courtesy has disappeared and each one tries to lead so as to be the first on the bridge. Just as on the rattan bridge at Brug-bivak, here also it was deemed advisable to permit only one person to cross at a time. The cliff on the other side appears easy of ascent because of the many projections and tree-roots, and very soon we are actually in the Timorinese territory and ascend along a steep but excellent path through the light and sunny forest. Higher up over gentler slopes, we pass native clearings surrounded by strong fences, and a quarter of an hour later we reach the Dika-bivak (Fragment I, Map B, no. 17), situated at about 1250 m. altitude in an open place on one of the horizontal paths leading toward the slope. Here I found the leader, the geologist, the doctor-anthropologist, and the controller-ethnologist. Happily my unexpected visit was well-timed, for it appeared even to tip the scale in favor of carrying into effect a plan that had been under consideration to terminate the expedition with a five days' journey into the principal valley.

Thus I received a number of impressions which are outside the limits of strictly scientific ethnology but perhaps have some claims to interest, which I present, with the observations on the country and the flora. Occasionally I have tested the impressions by, and in some measure modified them in accordance with, the scientific results of the work of Dr. Paul Wirz, the ethnographer of the Kremer Expedition, but in general I have restricted myself to the recording of personal impressions which, although without scientific pretence, nevertheless may possibly amplify the observations of professional ethnologists in some points. The fact, however, that I resided only a week in this remarkable region will certainly influence some of my comments where feeling has played a greater role than reason (cf. Wirz, p. 41).

I shall not discuss the difficult problem of the origin and composition of the race, which was recently treated by Bijlmer [7] and Wirz.[8] Wirz thinks [9] that the

[7] H. J. T. Bijlmer, Anthropological results of the Dutch Scientific Central New-Guinea Expedition A° 1920, followed by an essay on the anthropology of the Papuans. Acad. Proefschr. Leiden 1922, also in Nova Guinea VII, 4 (1923), 355—See also: Idem, Tijdschr. Kon. Ned. Aardrijksk. Gen. XXXIX (1922), 156, and De Aarde en Haar Volken (1923) 97, 121, 145, 169, 193, in 1924 published in book-form; J. Jongejans, Indië V, no. 35–37 (1921) and 41 (1922).

[8] Dr. P. Wirz, Anthropologische und Ethnologische Ergebnisse der Central Neu-Guinea-Expedition 1921–1922—Nova Guinea XVI, 1 (1924)—See also: Idem, Im Herzen von Neu-Guinea, Tagebuch einer Reise ins Innere von Holländisch Neu-Guinea (Zürich, Rascher & Cie. A.-G., 1925, illustrated).

[9] l. c. p. 5–8.

pigmy tribes in the Central Mountain Range are related particularly to tribes from the south, and even to Australians; the Papuans from the northern coast diverge rather strongly from the mountain-inhabitants and show more Malayan-Polynesian features. According to Bijlmer, however, one should not speak of two races; he thinks that a Papuan in the wider sense should be "for three quarters—and as for the New-Guinea pigmoids . . . for four fifths, a negrito and for the rest a Dravido-Australoid" (l. c. 79 and diss. 434, Nova Guinea).

Apparently the Timorini [10] have been in these valleys a long time. Wirz comes to the conclusion that the central race must be very old. We shall not become engrossed in the question of how they came to be here, whether they perhaps were forced inland from the plain by stronger tribes and finally abandoned nomadic life here to become settled farmers. The established fact that the contact of the mountain-dwellers with the natives on the northern side of the plain is relatively small is sufficient for us. We have incontrovertible evidence [11] that such contacts exist. Not only do the Timorini possess sea-shells which they obtained either by barter or by combat, but also their gestures left no doubt about their being acquainted with the presence of natives of larger stature to the north of whom they were positively afraid. By gestures they clearly indicated that a striking characteristic of these people was their nose-ornaments. However, that the contact with the plainsmen is slight is evidenced from the very few sea-shells in their possession, and the constant scarcity of these is best illustrated by the fact that the Timorini use the common cosmopolitan cowrie-shells (*Cypraea moneta*) as money, and that with one or two of these shells valuable articles or services may be purchased. In addition to the cowrie, which the Timorini call *tigalèh* (according to Wirz, *tinalèh*), they also have fragmentary parts of a larger sea-shell, possibly *Nautilus*. These pieces, called *melli*, form one of their most expensive ornaments; they are worn on a string around the neck. Even for a chopping-knife we could not obtain a single *melli*, but later it appeared that they could easily be secured in exchange for *tigalèhs*.

Apparently the contacts between the northern plainsmen and the people of this part of the Central Mountain Range occur only at one or two places, where the Swart or Iliem River and the Baliem flow from the mountains into the Meervlakte (cf. Wirz l. c. 123). The members of the Kremer Expedition noticed that the mountain Papuans call not only the great tributary which rises near Wilhelminatop, but also the Idenburg the Baliem; whereas, the name Iliem is applied to the Swart River (below the Dika) as well as to the van der Willigen River. When we reflect on how thinly the vast Meervlakte is populated,[12] and furthermore how poor in marine products these people are as compared with the men of Pionier-bivak, then it is clear that apparently the lapse of many centuries has been necessary for the Timorini to accumulate such a relatively large number of these shells.

[10] According to Wirz (l. c. p. 2, footnote 2) the names such as Timorini, Oeringgoep, Pesegem, and so forth, do not have the significance of tribal names as we understand them. They are more in the nature of geographic designations.

[11] Cf. Wirz' account of some Timorini accompanying the Kremer Expedition on the return journey to Prauwen-bivak (l. c. p. 125).

[12] According to the cited report, Verslag Mil. Explor. Ned. N. Guin. 1907–1915, the total population of Netherlands New Guinea was estimated at about 180,000 people (p. 240); those on the banks of the Rouffaer River at the junction, where apparently the Swart River empties into it, number about 10,000; cf. also the population map opposite p. 296.

In addition to the shell evidence, I suggest another means by which one may reach the same conclusion, this being in the domain of cultivated crops and ruderal plants. From the phytogeographical point of view the last category is the most important. The adventive plants have been spread indirectly through the contacts of peoples and through their trade-routes. Cultivated plants are directly distributed by the people themselves. We shall begin with these.

The plainsmen in New Guinea have grown [13] *oebi* [14] *djawa* [sweet potato] (*Ipomoea Batatas* Lamk.), cassava (*Manihot utilissima* Pohl), *ketimoen* (*Cucumis Melo* L.), *laboe* (*Lagenaria leucantha* Rusby = *vulgaris* Ser.), tobacco (*Nicotiana ?Tabacum* L.[15]), *watti* (*Piper methysticum* Forst.), *lombok rawit* (*Capsicum frutescens* L.), banana (*Musa* sp.), *pinang* (*Areca Catechu* L.), coconut (*Cocos nucifera* L.), *katjang* (bean) species, taro (*Colocasia esculenta* Schott), papaya (*Carica Papaya* L.), soursop (*Annona muricata* L.), sugar-cane (*Saccharum officinarum* L.), and maize (*Zea Mays* L.). In the Arfak Mountains potatoes are also cultivated. Most of the species are to be considered as secondary foods. The chief food in the plains is sago; that of the mountainous region is sweet potato.

The Timorini cultivate the sweet potato (Tim.: *bei*), banana (*lawi*), *pandan* (*Pandanus* sp.), *sirih* (*Piper Betle* L. or a related species), taro (*kôm*), sugar-cane (*ēn*), *pinang*, *katjang ketjipir* (*Psophocarpus tetragonolobus* DC.), *laboe* [*Lagenaria*], and tobacco (no. 2075; *Nicotiana Tabacum* L.). Wirz (l. c. p. 86) records the cucumber (*gila*, *koemak*). He mentions also (p. 87) a shrub with "gelappten Blättern und gelben Blüten," which was grown and used as food by many tribes in New Guinea. Possibly this was the pantropically cultivated *Abelmoschus esculentus* Moench. When we now trace what is known of the origin of these plants, we find the following. The sweet potato is native in tropical America. The time of its introduction into Asia is not definitely known. During the time of Rumphius (1650–1700) the plant was already in cultivation everywhere in the Archipelago. Possibly the sweet potato, with the tobacco,[16] belongs to the very anciently cultivated plants which were spread

[13] Verslag Mil. Explor. . . . p. 298 et seq.; L. S. Gibbs, Dutch N. W. New Guinea (1917), 17.

[14] Van Nouhuys (Nova Guinea VII, 1 [1913], 8) identified *oebi* as *Dioscorea*. The tubers of both *Dioscorea* and *Ipomoea* have been called *oebi*; to distinguish the two, *Ipomoea Batatas* Lamk. is usually called *oebi djawa*, or *bataten*.

[15] Van Nouhuys reported to me in a personal letter that he encountered, among the Pesegem, a species (according to his recollection) with greenish yellow flowers, which perhaps was *Nicotiana rustica* L. Whether this species occurs in New Guinea is uncertain, partly owing to the indifference of members of the various expeditions to the collection of cultivated plants, and partly because the opinion of a specialist is necessary to determine the collected material. Chevalier (see footnote 16) names a large number of species of which surely various ones might be expected to occur in New Guinea. So far as New Guinea is concerned, only two specimens of *N. Tabacum* L. are in the Buitenzorg Herbarium, one from the Kaiserin-Augusta River (Hoofd-bivak, *Gjellerup 368*) and one from Temena (Northern New Guinea, *Wichmann 188*). *Nicotiana rustica* L. is not represented by any specimens from the Netherlands Indies.

[16] It is remarkable that the Timorinese words for tobacco (*tabo*) and for pipe (*taboaak*) appear to be derived from the Malayan (*tabako*) and thus indirectly from the [American] Indian word. This may be an indication that the plant reached the Timorini through direct or indirect contacts with the Malayans. The Pesegem have different words, *mbali* for tobacco and *kanoem* for pipe. Van Nouhuys (l. c. 11) reports that tobacco is not known by the tribes along the lower course of the Lorentz River, but only by the Pesegem. Otherwise the plant is widespread in New Guinea, and the reason for its absence in the Lorentz River region is probably owing to the fact that the tobacco plant does not thrive where there is too much soil moisture. According to Heyne (De Nuttige Planten van Nederlandsch-Indië, ed. 2, 1927, p. 1354)—who lists only *N. Tabacum* L.—tobacco flourishes best in dry soil, which condition apparently is not character-

from America to this region seemingly long before the arrival of the Europeans (Spaniards, 1545) in the Archipelago. Thus it is not necessarily surprising that this plant now appears even in the remote valleys of the Timorini. The banana,[17] *pandan*, and betel may be native. The use that is made of the betel-leaf is possibly not autochthonous. Taro, *laboe*, and *Areca* are indigenous in southeastern Asia. From time immemorial sugar-cane has been cultivated in Old World tropics; perhaps the primitive form (*Saccharum spontaneum* L.) is indigenous in the Archipelago. *Katjang ketjipir* [*Psophocarpus*] is likewise a plant of tropical Asia; it is an important fact that it was introduced into Amboina during Rumphius' time, because apparently the plant reached New Guinea shortly thereafter. These cultivated plants may have been introduced by bird-hunters and traders, but once introduced they gradually extended from the coastal regions into the interior. Undoubtedly a long time was necessary for this distribution.

Now we come to the ruderal plants. In Fragment III, I have defined these. I group them here as follows:[18]

I. Cosmopolitan in temperate to tropical regions:
   1. *Oxalis corniculata* L. (no. 2059)
   2. *Eleusine indica* Gaertn.
II. Tropical cosmopolitan:
   3. *Sida rhombifolia* L. (no. 2064)
   4. *Drymaria cordata* Willd.
   5. *Urena lobata* L.
   6. *Ageratum conyzoides* L.
   7. *Bidens pilosus* L.
III. Tropics of the Old World:
   8. *Adenostemma Lavenia* O. Ktze. (no. 2087)
   9. *Cyathula prostrata* Bl. (no. 2069)
   10. *Polygonum nepalense* Meisn. (nos. 2054, 2066)
   11. *Senecio sonchifolius* Moench (no. 2052)
IV. Tropical Asia and Australia:
   12. *Crepis japonica* Benth. (no. 2053)

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istic of the Lorentz River region. If it is a fact that tobacco is not grown there, it seems strange that the natives of this region should not know and smoke tobacco, because tobacco is an important article of commerce in New Guinea. It is known that the Timorini pack tobacco for barter with the Meervlakte dwellers for *tigalèhs*, etc., and it might be expected that the Pesegem would do the same with the inhabitants of the adjacent lower regions.

Long after the above opinion on the time of introduction of tobacco and sweet potatoes into New Guinea was recorded, I received a paper from a well-known French specialist in the field of tropical cultivated crops, Dr. A. Chevalier (Les Origines du Tabac et les débuts de sa culture dans le monde, Edit. d. l. Revue internat. des tabacs, Paris, 1927). The author reaches the conclusion (p. 13) that the peoples of the southwestern parts of the Pacific Ocean and of southeastern Asia knew the tobacco and the sweet potato before the discovery of America by Columbus. In view of the high degrees of civilizations which were developed centuries earlier in Central America, and the seafaring proclivities of Polynesian peoples, this need not be surprising. These and other cultivated plants, according to Chevalier, through the agency of man, perhaps also by birds or even on driftwood, might have extended via the numerous islands of the Pacific Ocean far to the west. I suppose that here in particular the influence of man must be considered. Tobacco was first introduced into Java by the Dutch in 1601, but one might assume that it was known much earlier in the Moluccas and seemingly also in New Guinea. Van Nouhuys informs me that, from old travel-records, it is apparent to him that tobacco occurred in Ternate in 1599 and that slaves (Papuans?) especially used it.

[17] Cf. Cammerloher, Zur Frage der Heimat der Banane—Oesterr. Bot. Zeitschr. (1922), 262.

[18] There was very little opportunity to collect, and hence not all the ruderals could be assembled. Those actually collected are listed with their herbarium numbers. In other cases I have taken the names from my notebook. The determinations were made by Mr. C. A. Backer.

V. Tropical Asia:
13. *Nasturtium indicum* P. DC. (no. 2086)
14. *Oenanthe javanica* DC. (no. 2076)
VI. Java:
15. *Plectranthus* (aff.) *javanicus* Benth. (no. 2057)
16. *Lobelia succulenta* Bl. (no. 2061)
VII. Australia:
17. *Mitrasacme elata* R. Br. (no. 2077)
18. *Oldenlandia tenelliflora* K. Schum. var. *papuana* Val. (nos. 2065, 2085)

The difference in altitude partially explains the dissimilar ruderal floras of Pionier-bivak and Swart Valley.[19] Only two of the plants named are common to both areas, *Ageratum conyzoides* L. and *Eleusine indica* Gaertn., both of which occur in Java and which extend into the mountainous region. Some, however, have become established because a certain type of selection is associated with adaptation for dissemination.

We shall now try to trace the means by which these plants may have reached these isolated valleys. The first approach to this question is by an examination of the peculiarities of fruits and seeds. Apparently the natural methods of distribution in this case, as far as the region is concerned, are perhaps more applicable than the possible coöperation of man. But man's work in the preparation of the land becomes a premise to natural dispersal. In the following survey we shall confine our remarks to 15 of the ruderals mentioned—nos. 17 and 18 are not true adventives—and *Plectranthus javanicus* Benth. is omitted because of its somewhat uncertain determination. We find then:

A. Wind-dispersed:
1. *Ageratum conyzoides* L., fruits with pappus.
2. *Senecio sonchifolius* Moench, idem.[20]
3. *Crepis japonica* Benth., idem.
4. *Polygonum nepalense* Meisn., with winged fruits. This species belong in category B equally well; the seeds are very small and round.

B. Possibly distributed by men and animals:
(The fruits and seeds of this category of plants are very small and without particular characteristics; often one thinks that such seeds lend themselves to distribution by man, although wind-dispersal is not impossible)
5. *Lobelia succulenta* Bl.
6. *Drymaria cordata* Willd.
7. *Eleusine indica* Gaertn.[21]
8. *Oxalis corniculata* L.; the seeds are ejected in much the same way as those of *Impatiens*, by the bursting of the fruit.
9. *Oenanthe javanica* DC.; seeds somewhat larger than in the previous species.
10. *Nasturtium indicum* P. DC.

C. Can be spread by animals, particularly birds:
11. *Bidens pilosus* L., fruit with two barbed awns.
12. *Adenostemma Lavenia* O. Kuntze, seeds with four stiff projecting pappus-hairs, and glutinous.
13. *Cyathula prostrata* Bl., fruits with numerous tiny hooks.[22]
14. *Urena lobata* L., seeds with curving hook-like prickles.
15. *Sida rhombifolia* L., seeds with a stiff hard awl-shaped prickle.

[19] In addition perhaps one should add to the ruderal flora a few unnamed representatives of *Jussiaea*, *Aneilema* (no. 2073), *Commelina* (no. 2074), a few Scrophulariaceae (nos. 2063, 2078), Compositae (no. 2050), Gramineae (nos. 2055–6, 2068), and Rubiaceae. The number of ruderal plants in the vicinity examined is apparently about 30.

[20] Cf. Docters van Leeuwen, Ann. Jard. Bot. Buitenz. XXXI (1920), 127.

[21] Docters van Leeuwen records the distribution of this plant by birds (l. c. 130).

[22] Doctors van Leeuwen, l. c. 126.

We sum up the data obtained in a small survey of the ruderal flora of Pionier-bivak and the Swart Valley:

	Pionier-bivak		Swart Valley [23]	
	Number	%	Number	%
DISTRIBUTION	17[24]	—	15 (±15)	—
Tropical cosmopolitan	9	53	7	47
Tropics of the Old World	12	71	11	73
Tropical S. E. Asia	17	100	14	93
Possible means of dispersal				
Man	14	82	7–6	47–40
Wind	2	12	3–4	20–27
Birds	1	6	5	33

Naturally many and important conclusions cannot be drawn from so few data. From the above survey, however, it is striking that the components of the ruderal flora in both regions are practically the same, in spite of the vastness of the area. This doubtless is an important factor, since it perhaps implies that the ruderal flora in both regions has reached about the same state of development. In the easily accessible Pionier-bivak, the ruderal flora was at most seven years old. In the vast central mountainous region much more difficult to reach, where the ruderal flora is in about the same condition, but more abundant, it must have taken a long time to develop thus. Since we do not know the comparative value of the accessibility-factor for both areas, it is impossible to estimate the length of time. We know that hundreds of kilometers of primeval forest separate the mountain-valleys from the nearest cleared areas outside, and further we know that communications between the two are sporadic. Opposed to these hindrances, the vastness and age of the cleared land in the mountain-valleys [25] is a favorable factor. Hence we must conclude that a very long time can be the balancing factor between the two. In connection with this, the fact is clearly brought out in the survey that probably distribution by man is preponderant (82%) in Pionier-bivak; whereas the same factor in the Swart Valley applies to less than half of the ruderal flora observed there (±45%).

Contacts of the valley people with the northern tribes have been much discussed, and this surely claims our attention. We noticed it on the northern boundary of the inhabited territory. The Kremer Expedition, however, has shown that a well-beaten path traverses the Central Chain via Wilhelmina Pass (Fragment I, Map A) to the south. The trail extends some tens of kilometers across uninhabited territory, connecting the region settled by the mountain Papuans north of the Central Chain (Peninggalèh) with that occupied

[23] Nos. 15 (determination uncertain), 17, and 18 (apparently native) from the list as given are not included.

[24] The numbers given for Pionier-bivak are not the same as mentioned in Fragment III. Here *Momordica cochinchinensis* Spreng. (nos. 629, 630) is included, a plant indigenous in S. E. Asia and apparently imported here by man. The leaves are eaten as greens; the fruit is rather large and studded with obtuse prickles; the seeds are surrounded by an aril and the juicy flesh of the fruit; possibly these are eaten by birds and thus dispersed.

[25] A possible thoroughfare from Etna Bay and Geelvink Bay to the east through the longitudinal valleys of this central mountain-land ought to be considered.

by their congeners, the Pĕsĕgĕm (pronounced with soft g). These Pĕsĕgĕm,[26] discovered in July 1907 by the First Lorentz Expedition, further studied in 1909 by the Second Lorentz Expedition and in 1913 by the Franssen Herderschee Expedition, dwell in valleys having much more convenient communications with the plain than has Swart Valley. Barter with the plainsmen is probably very easy, and likewise there exists a rather heavy traffic with the Timorini; that is, assuming that a number of the possessions of the latter have come to them from the south. On the other hand, various writers, such as Pulle,[27] Snell,[28] and van Nouhuys,[29] mention the fact that the Pesegem informed them that shells [30] in their possession came from the north. Snell (l. c. 71) surmised that the stone of their axes also—probably not chloromelanite but andesite, perhaps of the northern mountain series—came from the north. The Kremer Expedition learned, in agreement with the reports of the other writers on the Timorini in the southern valleys, that they are on good terms with the dwellers on the other side of the Peninggalèh. Thus on this degree of longitude, the mountainous area of New Guinea over its entire breadth, excluding the uninhabitable alpine parts, is populated by the same mountain-tribe. That this tribe, however, extends still farther toward the west and the south we may determine from the reports of de Kock [31] and van den Broek [32] on the Goliath Papuans (the abominable combination Goliath-pygmy has frequently been used, and thus by analogy one should likewise expect David-giants), Wollaston's report [33] on the Oetakwa Papuans and the Tapiro, and Detzner's [34] on the tribes inhabiting the mountains far east in the Australian part of the country. Doubtless the tribes to the north of Carstensz Peaks investigated by Leroux and Stirling of the Nederlandsch-Amerikaansche Expedition belong to this same race.

To illustrate the conformity between the Timorini, the Pesegem, and the Oetakwa Papuans, I briefly enumerate some points of likeness and difference among these tribes. We begin the comparison with the Pesegem. First, numerous words in the speech are identical or show some resemblance. The stature and the height are strikingly similar in both this tribe and the Timorini. Among the Pesegem the women have shorter hair than the men, and the children frequently have reddish-colored hair. Again among the Pesegem one observes finger-mutilation such as is practised chiefly by women of the Timorini. The Pesegem wear a gourd penis-sheath, arm-bands, and necklaces like those of the Timorini, as well as a hair-net and small carrying pouches. The ropes are of the same type in both tribes and are smeared with oil (Snell speaks of wax); the entire body also is greased. Pigs' tusks, bandoliers made of pig-

[26] Maatsch. t. Bevorder. v. h. Nat. Onderz. d. Ned. Kol. Bull. nos. 58, p. 18, and 62, p. 17, and 68—H. A. Lorentz, Zwarte Menschen, Witte Bergen (Leiden 1913)—Van Eerde, Tijdschr. Kon. Ned. Aardrijksk. Gen. XXVIII (1911), 49—Pulle, l. c. (see footnote 27)—Van den Broek, Nova Guinea VII, 3 (1915), 233—Van Nouhuys, l. c. (see footnote 29)—Fischer, Nova Guinea VII, 2 (1915), 145.

[27] A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, p. 172.

[28] L. A. Snell, Maatsch. t. Bevorder. v. h. Nat. Onderz. d. Ned. Kol. Bull. no. 68 (1913), 57.

[29] J. W. van Nouhuys, Der Bergstamm Pesechem, Nova Guinea VII, 1 (1913), 91.

[30] Perhaps the muddy southern coast does not provide shells!

[31] Tijdschr. Kon. Ned. Aardrijksk. Gen. XXIX (1912), 154.

[32] Ibidem XXVIII (1911), 821.

[33] A. F. R. Wollaston, An Expedition to Dutch New Guinea—The Geographical Journal XLIII (1914), 248—Idem, Pygmies and Papuans (London, 1912).

[34] H. Detzner, Vier Jahre unter Kannibalen (Berlin, 1920).

skin, seashells, and orchid stem-fibers are ornamental articles sought by both. The stone axes of the Pesegem have the same form as those of the Timorini. Their wives, who also do the field work, use the same kind of net-sacks, while, on the top of these, they carry their babies in a small net. The larger children sit astride a woman's shoulders and grasp her hair. The Pesegem are described as peaceable and gentle, the young men being noisy and the older calm and composed. The Timorini can be characterized in the same way. The fire-making methods in the two tribes are almost identical. When surprised the Pesegem tap the penis-sheath. The arrows used by both tribes are almost alike, three or four types being exactly the same. Both have pigs for live-stock and shelter them in their houses. The dwellings differ greatly, but both tribes have in common a preference for living on mountain-ridges, and in both the sexes live separately. Both practise intensive cultivation and raise the same crops on their steep enclosed fields; the chief food of the Timorini and the Pesegem is the sweet potato. Both eat their food raw or after roasting it in pits covered with stones. The tobacco pipes observed in the two tribes are very similar. The "mouth organ" of bamboo or *gelagah* stem is used by both tribes; the Pesegem also chant monotonous choral songs with short repeated refrains. The same ceremonial is used in establishing a blood-friendship as is encountered amongst the Timorini.

Although the Timorini and the Pesegem resemble each other in very many ways, there are, nevertheless, important differences to be enumerated. The usual costume of the Pesegemese women consists of two small grass cushions, that of the Timorinese women is a string skirt. The few times that we encountered the grass costume among the Timorini, it was inferred that the wearer was of Pesegemese origin. The Pesegem too have a peculiar raincape made of *Pandanus* leaves, not found among the Timorini; possibly it rains more on the south slope of the mountain-range than in the high valleys of the interior. The women of the Pesegem wear the carrying net not from the forehead, as do those of the Timorini, but from the crown of the head, this practice at times producing a localized bald spot. The most important difference between the two tribes, however, except in the speech, lies in the fact that the houses for women are four-sided and stand on piles, whereas, the house for men, usually one per kampong, is circular (similar to all the houses of the Timorini) and built on the ground. The Pesegemese men usually surround their kampongs with a fence, this being seldom the case with the Timorini. Lastly the Pesegemese men wear a number of rattan bands around their waists; this is unknown to the Timorini. The latter also lack the strings which are pendent from either side of the penis-sheath of the Pesegem.

The Oetakwa Papuans, who live so much farther from the Timorini, show hardly any differences. They appear to be nearly related to the Pesegem. Their houses are four-sided; they grow sweet potatoes as their principal food, and in addition sugar-cane, taro, ginger, bananas, and tobacco, frequently in terraced fields on steep slopes. The highest cultivated land there was at an altitude of 2000 m., but deforested areas were seen up to 2400 m. The people were very friendly and not at all frightened. "They were quite fearless from the first; they strolled into our tents or huts as if they had been accustomed to do so all their lives," says Wollaston in the above-cited publication. The build and height of the Oetakwa are similar to those of the Pesegem and the Timorini. The photographs illustrating Wollaston's article are strongly Timorinese in

character. We see the same stature and features, the same necklaces of seeds and *Echidna* spines, the same bags woven of string. We recognize the high caps of cassowary feathers and the ornaments of *koeskoes* fur. Wollaston mentions penis-sheaths for men, small grass cushions and large carrying nets for women. Ornaments of *Dendrobium* fibers are as widely known as cowries and other sea-shells; when questioned as to where the last came from, they pointed always to the east (the Pesegem?), never in the direction of the coast. The Oetakwa had a few iron axes of unknown origin and many stone axes made of "metamorphosed slate" (slate rock? ?), according to Wollaston. Small stone knives also were in their possession. Pigs' tusks and tails were used as trimmings, and fire-making was like that of the Timorini. The Oetakwa have similar tobacco pipes. They salute an acquaintance in the same fashion as the Timorinese people. Wollaston mentions the very characteristic manner of pulling knuckles. He also records that when surprised they tap the thumb-nail against the penis-sheath. Their temperament is cheerful and noisy and they likewise have a "Jew's harp," undoubtedly the same as the "mouth organ" of the Timorini and the Pesegem.

Involuntarily the question rises: Did the Timorini know of the existence of white men before our arrival? I think the answer is definitely in the affirmative. Centuries ago the coastal native knew the white man, and during the course of years such an important fact in some form doubtless penetrated far into the interior. Probably the facts that the dwellers of the Meervlakte first in 1909, and the Pesegem in 1907 and 1909, really came into contact with the white people have been no more than affirmations of something which, for many, must have sounded like a kind of fairy tale. Nevertheless, really getting acquainted with us must have been a big event in the lives of the Timorini. I once tried to imagine what went on in the minds of these people, not only in the individual life of each, but also in the lives of their associates, when we appeared for the first time, engaged in a multitude of, to them, completely incomprehensible matters. It will be sufficient to refer to the description of the first contact given by Bijlmer and Jongejans. In the later days of our sojourn particularly, we were often surprised that we Europeans proper were always much more amazed and interested than our hosts. As we try to explain this fact, we must consider that a people in this stage of evolution are as children compared to us. The Timorinese individual is, even in our eyes, an excellent man but primitive; that is, his mental processes are much more unconscious than ours, much less complicated, and lack the power of coördination. We can consider him as a kind of intermediate form between the "intelligent" mammals, such as dogs or horses, and ourselves. I do not discuss the position of this intermediate form. In his inner being are the same seeds of good and evil as in ours. Every day, every hour, every minute, we are again touched by expressions which we encounter in our own race. His society is like ours but on a strongly reduced scale. Can one say the same of the mongoloid races? (East is east . . . etc.) Why did we find the Mamberamo Papuans such unredeemed brutes, and yet accept the Timorini, likewise primitive, as our fellow-men? Surely not because they have climbed a few steps higher on the ladder of refinement! Can it be that there are two kinds of primitiveness, crude and cultured? And did our own race in its primeval condition belong to the first type? I leave the answers of these questions wholly to the ethnographer and philosopher. But it is strange to observe how

there exists among such primitive and isolated people the same proportion between old age and youth as amongst us. The children are true children, the boys real street boys, the girls are genuine girls, and the old men real old men. Nevertheless, there remains a child-like standard. They are, as it were, ghostly neoteinic forms undeveloped in depth and breadth of conscious outlook, and this is an indication of the phylogenetic youth of such a people. Ontogenetically, probably the Timorini can be developed as most Europeans. Their present stage of development as a people apparently does not separate them from us by an insurmountable gap; the phylogenetic development is not to be forced. Here agents are at work which need a very long time for each change or else are inactive. So the ratio between age and youth during the phylogenetic development remains constant. Whereas the nature of the child of phylogenetically young and old nations hardly differs appreciably, we find at the end of life a very great difference, since that is in proportion to the phylogenetic age of the people. As is true of our own people, we find the Timorini courageous and cowardly, honest and dishonest, reserved and demonstrative, noisy and quiet, wags and thinkers, coquettish and modest, boasting and unpretentious, naive and suspicious. We observe a people here who developed undisturbed in peace and quiet, a people who have refined a large measure of good nature and flexibility from the influence of the earth and its surroundings. In such a people we find the best of the animal elevated to the status of humanity. We feel much nearer to him than to the young Javanese. The latter has already arrived through the elimination of isolation. Originally his soul was pure in nature, but now it is troubled by a multitude of ideas which properly belong to a society phylogenetically older; hence, these ideas promote a dissonance with the sound of chords tuned to entirely different standards.

Why was it that these Timorini appeared to be so much less affected by our arrival and its accompanying wonders than we had expected, than we ourselves were? I believe it was because they, in phylogenetic youth, therefore like children, are simple. That inconceivable something which we brought them, they accepted as they accept so many other incomprehensibilities. In their largely unconscious spiritual life, they try not to estimate these; whereas we, frequently at the cost of our tranquillity, cannot desist from so doing since we have eaten of the fruits of the tree of knowledge.

The Timorinese individual is slender and slight but well-built. Bijlmer gives as average height of the men 154.7 cm. (Wirz, 155.7), for women 143.2 cm. (Wirz, 147.3). Thus the Timorini certainly are not pygmies. Of 40 Dyaks who accompanied the expedition, the average height was 155.9 cm., but one never hears this tribe spoken of as pygmies. The children almost all have the characteristic "sweet potato" stomachs, but this feature disappears in later life. Whereas the men generally retain their beautiful supple figures, the women, who do all the heavy work, age early and become plain.

In men frequently the entire body is covered with small tufts of frizzy hair; most of them have a full beard and mustache. The facial expression is usually friendly and good-natured, sometimes alert and sometimes gentle. The deep-set eyes appear open and intelligent under the projecting heavy eyebrows and impart to the face something of candor. The men go naked, since the penis-sheath is considered as an ornament rather than as clothing, although, on the other hand, a sense of shame is not lacking in the Timorini. The small net of

knotted string,[35] often locally wrapped with yellow orchid-fiber and decorated with colored leaves or with feathers, is worn by mature men on the head. It is firmly attached to the curly black hair with pork-fat colored black by soot and will remain in its place many years. An end hangs at the back and appears to consist of several layers, for often I saw the outside layer raised in order to place some object beneath it. Nevertheless, we observed mature men with uncovered heads of curly hair.

Many men wear thin or thick rattan sticks or more or less sharpened pigs' tusks through the nasal septum or through the ear-lobes, and sometimes two such tusks are bound to a ring. Coarse twisted rattan bands are worn on the neck, and strings of seeds, such as those of Job's tears (*Coix Lacryma Jobi* L.), or internodes of thick-stalked grass. Most of these strings are long and one short end, consisting of the spines of porcupine ant-eaters (*Echidna*), hangs down. An unusually valuable ornament is the previously mentioned *melli*, a piece of large sea-shell (*Nautilus?*); relatively few men had it, and many young men indicated a vehement desire for the white paper leaves from our notebooks as a cheap substitute.

An ornament worn much by men is a bandolier of knotted string (Wirz, l. c. pl. X, fig. 5) on which a number of objects are hung, particularly short sticks of bamboo or rattan on which a piece of long-haired pigskin is fastened, also larger pieces of pigs' feet or those of cassowaries. Each man has a shoulder-bag in which he carries some useful things and some luxuries: a small dagger fashioned from a cassowary leg, a pipe (*Fig. 29*) made from an excavated fruit with a hollow grass stem, a small case for lime, made from a *laboe* fruit, a couple of betel leaves and an *Areca* nut, a few leaves of tobacco, and, if he is well-to-do, a few *tigalèhs* [cowrie shells]. With that he carries some provisions or tidbits, a couple of roasted sweet potatoes, a small piece of sugar-cane, and some beetle-larvae.

The arms are often decorated with a few plain finely or coarsely twisted rattan-bands (Wirz, l. c. pl. VI, fig. 2–5); they are either the customary short cylindric form, or the horizontally projecting type [somewhat flange-like] wherein the outer and inner margins form two concentric circles (Wirz, l. c. pl. XII, fig. 1–3). Perhaps the latter were originally arm-protectors against the springing back of the bowstring, but the band is worn also on the upper arm.

Descending along the body we now come to the penis-sheath or *keboaak*. The strangeness of this frequently very provoking article was that it very soon was no longer striking. In youth the boy is girdled with a small-size child's *keboaak*. It is made of the basal part of the *laboe* fruit (*Lagenaria leucantha* Rusby = *vulgaris* Ser.) or gourd. Heyne[36] mentions that these old or mature fruits with hard woody walls are used as containers for various liquids; in Java these are artificially moulded by bands tied around them during the growing period. In view of the many different models which occur amongst the Timorini, one must suppose that this custom is also in vogue here, but neither Wirz nor myself were able to ascertain it. The *keboaak* rests on the base of the penis which is almost entirely concealed; it is attached in the middle to one or usually more bands fastened around the waist and by a thin band under the scrotum. There is a band around the waist to fasten the article in position. As for the difference in models, perhaps that is a question of age or social status.

[35] For finery, etc., see the ample report of Wirz (l. c. 102 et seq.).

[36] K. Heyne, De Nuttige Planten van Nederlandsch-Indië, 2nd ed. (1927), 1423.

There is a type which might be called that of the common citizen, the predominant and less conspicuous model, the short straight sheath. Most are thin and sometimes closed at the end (fruit-stalk), but there are also some of the model of the old blunderbuss (Wirz, fig. 2, fig. 7, middle man), being wide, thin-walled, or even thick sheaths, the outer end of which is closed with a wad of grass. According to Wirz, similar models are used as depositories for small articles such as *tigalèhs*. The exceptional models differ in length and form. We saw some which were coiled and curved, a few even recurved. I also remember a very old man whose *keboaak* projected upward to his hollow chest (cf. Wirz, fig. 32).

Some writers consider the *keboaak* as ornamental rather than as an article of clothing; one cannot deny the Timorini a sense of shame. I never saw a mature man without a *keboaak*, and when such an article was to be bartered, always an extra one was first brought from home and the "change of clothing" took place behind a bush.

As is to be expected of an article so closely connected with sexual aspects, the *keboaak* takes a particular place in the life of the Timorini. Without exception, the expression of astonishment, at the sight of our remarkable possessions for example, the guttural sounds are constantly accompanied by a repeated tapping of the nail of the index-finger or thumb against the *keboaak*. Perhaps this may be considered as an appeal to the saint of the sexual organs as exorcism lest the stranger whom he beholds shall bring him calamity.

In addition to the daily equipment previously described, the Timorini have a number of other occasional bags. They have a beautiful, woven, firm, strong, and very flexible piece of armor (Wirz, l. c. pl. XII, fig. 5), a kind of coat-of-mail made of fine rattan, the supple upper part of which covers the shoulders, while the coarser part protects the torso against arrows. They have various kinds of head-dress: caps of cassowary feathers pompous as a hussar's busby easily spoiled by rain, caps of *koeskoes* fur, head-bands for dances consisting of a broad strip of *Pandanus* leaf bound in U-form and decorated with bits of *koeskoes* fur and feathers of different birds (Wirz, l. c., pl. VIII, fig. 1). Finally they brought a ring-shaped rattan object with singularly long cassowary feathers attached to one end (Wirz, l. c. pl. VIII, fig. 3), and, holding it erect on the head, danced to and fro before us.

We frequently wondered of what material the beautifully twisted and strong string of the Timorini was made. I was unable to obtain definite information. The Industrial Section of the Department of Agriculture, Industry, and Commerce at Buitenzorg answered my inquiry, stating that it does not come from *Pandanus* aerial roots. Perhaps the origin must be sought in *Gnetum Gnemon* L., the bark of which is used everywhere in the Archipelago for manufacturing a fine type of string. Wirz (l. c. 110) proposed the same source. Snell (l. c. 68) reported that the Pesegem use string made from the bark of a shrub resembling cotton. The *waroe* (*Hibiscus tiliaceus* L.) does not occur here. Possibly another species of *Hibiscus* (*H. sabdariffa* L.; *roselle*), is meant.

The weapons possessed by these strange mountain-people conform entirely to their build. The bows are small and light, and the arrows look more like children's toys than arms. These bear no conspicuous ornamental motives, only somewhat singular outline figures. Four types of arrows can be differentiated. Two of these have a long and sharp point of bamboo or bone, the one with barbed hooks, the other without. These two are intended for human

enemies. The third model is tipped with a very broad gently convexo-concave bamboo point sharpened at the end; this is the hunting arrow which is used in killing pigs for food. The fourth type has four short somewhat divergent points; this is used in hunting birds. Perhaps the form was developed because the arrow often remains in the body of the bird, and thus its possible loss is guarded against in the dense forest. Children practice shooting when very young, using small bows and short arrows with blunt points. The arrows are of bamboo or rattan, the bow of palm wood (*Kentia?*).

In contrast with the Mamberamo Papuans, the Timorini as a whole are not inseparable from their bows and arrows. They frequently called unarmed and usually seated themselves quickly when visiting the camp. As peaceable farmers, the Timorini are less attached to their weapons than to the stone axe. Two models of these are known. The one most often seen is the man's axe (*Fig. 24A*), which one might call a field-axe, the instrument being used in

FIG. 24. Timorinese axes: A = man's axe; B = woman's axe.

breaking up new land. It is made of a strong flexible branch with a part of the wood of the trunk still attached, the latter standing at an angle of about 60°. The branch is the handle; a sharpened stone is attached to the short part and reinforced by binding with a thick strong strand of split rattan. The stone is hard and tough, not flaking off, and has the dark green color of andesite. It is not clear where these stones were obtained. Possibly they were found in the eruptive Doormantop series. In this connection I recall Snell's remark on the probable origin of the Pesegemese stone axes, which evidently came from the north. Moreover, it is known that there is an active barter in this valuable article in New Guinea; one might even speak of it as a local industry, as van Eerde [37] reported. The asymmetrical sharpened half-protruding stone is easily removed from its binding, and this occurs frequently in order to grind out the nicks caused through its use. Often we saw a man occupied a long time with the sharpening of the stone, moving it to and fro over a wet piece of slate with great patience. This tool may cut the tree-trunks almost horizontally, or at least at a wide angle. It is astonishing that the Timorini are able to fell a tree of sizable girth, and in a relatively short time, with this, to our eyes, primitive tool. The axe is carried over one shoulder, the stone at the back, the point of the forked wood turned slightly outward.

The other kind is the woman's axe or house-axe (*Fig. 24B*), consisting of a straight club-shaped piece of wood with a thin handle; in the thick end a

[37] Van Eerde, Inleiding tot de Volkenkunde van Nederlandsch-Indië—Volksuniversiteits-bibliotheek no. 1 (1920), 57–58.

symmetrical sharpened stone is set in an opening which narrows towards the upper side. This axe is used for chopping wood.

In lighting a fire [38] the Timorini employ this method: a long stick split at one end, the two parts slightly separated by a small stone, is used. Associated with this stick is a piece of split rattan, the larger part of which is wound around the wrist in a thick armband, the rest, 1–1.5 m., being free. Some dry leaves, *Selaginella* and such, are piled in a small heap on the ground. On top is placed a small handful of a fungus-like substance resembling the material gathered from the leaf-axils of the sugar-palm in Java. Now the stick, already showing some grooves burned black, is laid on the heap of dry material and the free end of the rattan string is pulled through under the stick. Then the man presses the stick down on the pile with his foot, takes the free end of the rattan in one hand, the wound part in the other and draws the rattan quickly and forcefully to and fro. After a few pulls, smoke appears, and a moment later a flame which immediately attacks the fungus-like substance, then the leaves. Quickly the burning heap is taken up and fanned, the whole work taking hardly more time than we would need to light a small fire with the help of a match. Nevertheless, this method appears to the Timorini to be too time-consuming or is not satisfactory in unfavorable circumstances, for frequently we saw men carrying a piece of *Pandanus* trunk in the cavity of which a fire smouldered.

Although the women of the Timorini do all the house- and field-work, nevertheless they are not complete slaves. A woman is very clearly the minor part of the household, but the privilege of expressing her own opinion is not denied to her. As a rule her outfit is simpler than that of the men. She wears no permanent head-net on her short curly hair, and her few adornments consist of armbands, necklaces, or a single pigs' tusk. Her clothing is very seemly; we found three different types. By far the most common is the string-skirt (Wirz, l. c., pl. V, fig. 3; also fig. 24), composed of numerous bits of string hanging close together from a cord wound two or three times around the waist, which adjusts itself to the form of the body. In addition to these string-skirts, there is another piece of clothing consisting of two arched pendent draperies of string-network (Wirz, l. c. fig. 23), one front, one back, tied together on the hips. The third type, of which we saw only a few examples, is that commonly in vogue among the Pesegemese women; the skirt consists of a set of small grass-cushions (Wirz, l. c., pl. V, 4, and fig. 26), very thick and similarly cut in front and back. Probably the women who wore this model were originally from the Pesegemese region.

The women also wear net bags, but resting on the head is a bulky sack, which is worn with a broad band on the forehead and hangs down the back frequently to the bend of the knees. In this the daily harvest is carried from the field, and toward the end of the day women of all ages may be seen, but particularly older ones, trotting by the camp, bent under the load of field-produce.

The kampongs are generally small, at least in the part visited by our expedition. A few, two to five, houses stand together on a more or less flat piece of ground, always on a ridge, never in a ravine, which is often the only forested part of the slope. The ground around the huts is usually good, and is kept clean and clear. Close to the houses only a few cultivated plants, such as

[38] Cf. the descriptions and illustrations of the same method used by a mountain-tribe visited by Wollaston (apparently likewise in vogue with the Timorini) in Lorentz, Zwarte menschen, Witte bergen (Leiden, 1913), 137.

tobacco (*Fig. 25*), sugar-cane, gourd, or banana, are grown. A few times we encountered larger groups of houses such as in the Toli Valley (*Fig. 32* at *1*) where we counted some thirty houses scattered over a broad ridge.

As I have already noted, the sexes live in separate quarters; there is a hut for men, and others for women, children, and pigs. The men's houses (*Fig. 25*) are fewer in number; they occupy the best sites, are of better construction, and frequently have two exits. The walls are made of more or less flat planks 1.5–2 m. high, set upright adjacent to each other and bound or held together by long flexible roots or branches. The diameter of the house is 3.5–4 m.

FIG. 25. Men's house in the Dika Valley; a tobacco plant at the left.

The doorways can be closed with transverse planks, and often a large flat stone serves as a threshold. The roof is made of grass-leaves (apparently *alang-alang*) radially arranged and resting on a number of timbers also radially sloping from the peak of the house (Wirz, l. c. pl. XIII). On the first floor is the meeting room, the earth being tamped, and frequently in the middle a fire is kept. Under the roof is a sleeping loft, which the dwellers can reach via a notched beam leaning against the wall and leading to a manhole.

The women's houses, as a rule, are much less carefully finished. The openings between the planks of the wall are mostly closed with grass, and in place of a loft occupying the entire upper part of the hut, one finds two rooms, one above the other, the upper being the larger. Under the lower part is a closed-off area in which the pigs are kept, usually all sows, which from time to time are set free to mate in the forest.

The Timorini are not unmusical, but their music is exceptionally primitive (Wirz, l. c. p. 113, et seq.). The one instrument is the same as that described and illustrated by Snell (l. c. 73) for the Pesegem; it is a small bamboo-strip (*Fig. 26*) carried on a string around the neck; the free end is split into three adjacent parts, the two outer being the longer. According to Wirz, this primitive instrument, apparently widespread over all New Guinea, is very ancient. It is used to blow against as they hum, but we obtained the impression it was used more as a child's toy than as a musical instrument. Wirz, in his chapter on music, places much more emphasis on the singing.

The Timorini practise [39] intensive cultivation in agriculture, and this in such an extravagant way that one wonders how long the valley-tribes can still exist here without reaching the starvation-point. One might rightly consider that the vast *alang-alang* [*Imperata*] fields are not suitable for further culture. Cleared places are observed in all forms and stages of development; frequently the steepest are terraced. It seems that the Kremer Expedition to the interior encountered better-kept fields, properly weeded and drained by a system of ditches at right angles to each other. The cleared places which I saw were ill-kept and poorly weeded, so that the cultivated plants (sweet potatoes) were

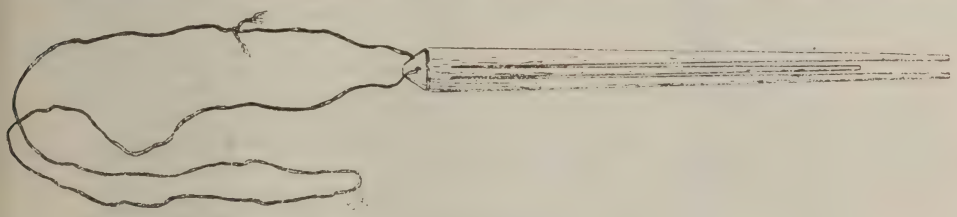

FIG. 26. Timorinese mouth organ.

practically hidden under the weeds. Neither blocks of stone nor tree-trunks were removed, but we must believe that we speak here of apparently newly cleared land on the margin of the inhabited region.

Likewise it has been mentioned that the sweet potato is the chief food and is almost exclusively the only plant cultivated in the fenced fields. Fencing is a necessary protection against the depredations of pigs, for failure of the *oebi* crop would have serious results. The fences (*Figs. 27, 28*) are real works of art. How poor the farm-lands of this primitive people must be, where agriculture, the oldest and most important business, has forced the inhabitants to develop such a remarkable technique with such primitive tools! These fences consist of a number of planks, not unlike those which are used for houses. They are placed horizontally one above the other to a height of 1–1.2 m. above the ground and are held in this position by perpendicular stakes on either side; the pairs of stakes are bound together and project two to four decimeters above the fence. In turn these stakes are supported by oblique ones braced against them, so that the whole structure is very firm. Frequently the upper side is covered with a broad layer of grass-leaves (*Fig. 27*), apparently for protection against rains which would soon cause the wood to decay. In this covering an epiphytic flora often develops, reminding one involuntarily of the attractive covering of the Balinese small hereditary walls.

[39] H. J. Lam, Iets over den akkerbouw bij een Papoeastam in Centraal Nieuw-Guinee, benevens eenige opmerkingen over land en flora van dat eiland.—Handel. IIde N. I. Natuurwetensch. Congr., Bandoeng 1922, p. 156.

FIG. 27. Stile over a *ladang*-fence, made of two inclined tree-trunks; a part of the fence at the left covered with grass.

FIG. 28. *Ladang*-fence with horizontal stile.

For us, the most noteworthy thing about these fences, however, is the fact that, where the path crosses, they have just such small stiles as we use in our Dutch meadow-fences. With his sense of travel, the Timorini keeps his paths in good repair, and where numerous fields must be passed, quick passage is not impeded. Sometimes the stile is made of thick tree-branches (*Fig. 27*) which, provided with notches, rest obliquely against the fence; then again it is made of horizontal small plank-steps (*Fig. 28*), in which case the fence is somewhat lower to facilitate crossing.

Near the huts small plantings of less important crops were frequently found, a small patch of sugar-cane, or in damp places a small *kladi* [*Colocasia*] field. Tobacco is usually grown near the houses (*Fig. 25*). Wirz thinks that this is done with an eye to protecting this valuable commercial material against

possible theft. Here and there are clusters of banana-plants with very small fruits; in another spot are a few *Pandanus* trees, of which the very often large infructescences approaching maturity are tied up with leaves like the *nangka* [*Artocarpus*] of Java, as protection against birds and bats. Betel also is cultivated near the house. Close to the large kampong in the principal valley I found a small planting of *katjang ketjipir* [*Psophocarpus*] which was trained over a kind of scaffold. In the neighborhood of this populous village I saw a rather extensive regularly laid-out *Pandanus* plantation. Repeatedly the places where these *Pandanus* fruits had been roasted were seen. They were small pits covered with flat stones, in which a fire had been built.

I shall now devote a few words to the Timorinese proper names, which Wirz does not discuss. Among the numerous clan-names which he reports, I found none which agreed with what we accept as proper names. We thought, moreover, that two categories could be clearly distinguished, one of which we considered the real name, and the other the reputed surname. In the first category we noted chiefly two endings, -gĕnak [40] and -ĕgom (frequently -boerĕgom) for men, and one, -kwé [41] (often -boerĕkwé) for women. Here are a few examples of these, a number of which sound not unharmonious with the cadenced pronunciation; the emphasis frequently falls (men, a and b; women, a) on the antepenult:

Men: a. Ending in -gĕnak—*Maingĕnak, Aligaingĕnak, Moelijèngĕnak, Tèrèngĕnak, Oendigĕnak.*
b. Ending in -boerĕgom—*Woebiliemboerĕgom, Kalanboerĕgom, Wolimanboerĕgom, Digienboerĕgom, Moelijènboerĕgom* (child, compare the same name with the ending -gĕnak), *Dahiendienboerĕgom* (child).
c. Ending in -gom—*Joekerónegom, Niengaragoenoegom* (child).
d. Ending in -kĕlèh—*Bongkokĕlèh, Anamboekĕlèh* (child).
Women: a. Ending in -boerĕkwé—*Kwamboerĕkwé, Jemberaboerĕkwé, Meniengènboerĕkwé.*
b. Ending in -kwé or -kwa—*Daroealĕkwé, Kwamoekwa, Toemakwa* (child).

We encountered names of another kind,[42] in part perhaps surnames; for men, for example: *Wawa, Oewe, Oewinèg, Djimawèh, Enggabitme, Tebiengèk, Adiengèk, Wégawòg, Endábòh, Didáralóe, Kwáloe, Djiwerái, Aboelòm, Ellemběroe, Oenaròh.* It becomes apparent that a few of these must be accepted as surnames. Snell mentions that in the Pesegemese "oewe" indicates father and "wawa" [43] an infant, which were aptly chosen as surnames and could very well refer to the appearance of the bearers.

Although we were convinced of the peaceable intentions of these people, we did not go about unarmed since the possibility of a misunderstanding could not be excluded. Besides, it again appeared that the Timorini, although on familiar terms with us in the camp, were not at ease if encountered alone. Frequently I noticed that individuals, whom one saw arrive, hastily tried to conceal themselves, or so they thought, in order to remain unseen. But in the open terrains such as cleared lands or grass-fields, this could not happen without being conspicuous. Now one must "faire bonne mine à mauvais jeu," for, as true primitive men, the Timorini have a strong sense of false shame. In such

[40] Also among the Pesegem; cf. Lorentz, l. c., p. 258.
[41] Among the Pesegem -kwe or -kwa(kwamie) means woman.
[42] Wollaston also reports (l. c. p. 260) that "many of them appear to have two names."
[43] In the Pesegemese this is also the name of a bird (*Ailaroedus buccoides* Temm.); cf. Lorentz, l. c. 468.

encounters they were frequently shy, sometimes also nervous, and I have noticed many times, particularly among individuals who did not know us, that they began to tremble with fear. But even people well-known to us, if met alone unexpectedly, often showed an ill-concealed terror by a clamorous cordiality and an exaggerated inclination to shake hands and embrace, this all being invariably accompanied by the tapping of the thumb- or index-finger-nail against the *keboaak*.

On the second morning of my sojourn in the Dika-bivak, after crossing a fence-stile in the margin of the secondary forest, I suddenly met a Timorinese family, man, woman, girl, and two boys. Apparently they had watched me cross the stile but had seen no chance to slip away. And now they stood as far to the side of the path as the slope permitted, lined up rather anxiously: the man in front, somewhat nervous but, nevertheless, controlling himself with the idea of keeping up his prestige; behind him the woman stood, more curious than frightened, the girl giggling half-hidden behind her, watching furtively to miss nothing of this meeting and yet poised for flight if I should make any move in their direction; the boys, bold and defiant, next to the father. The latter stood awkwardly waiting, and when I approached he began to shout reassuringly. Then followed an earnest handshake, then a fingerclap which I imitated. The female contingent pressed modestly into the background during this ceremony, but the two boys looked on undaunted, ready for severe criticism at seeing how papa would comport himself. When this ponderous and noisy ceremony was over, the usual gestures followed, each indicating his intention of proceeding on his journey, with which the scene ended. Here I have spoken of the method of salutation which was one of the factors in establishing our easy familiarity with these people. The Timorini (cf. Wirz, l. c. 45) greet one with a certain stately earnestness and firm handshake which meanwhile appears to be only a part of the ceremony. Frequently the handshake is preceded by an action in which the two individuals produce a clapping sound, the index finger and the middle one of the right hand curve and grasp tightly those of the other, the hands then being pulled with a jerk (the "pulling knuckles" of Wollaston). Often the handshake following this is less seriously, even somewhat carelessly exchanged; also it is superseded by the clasping of each other's forearm, apparently indicating greater cordiality. It appeared to us that they were more cordial when the ceremony was completed by a protracted embracing (cf. also Snell, l. c. p. 74, with the Pesegem), in which one laid his chin on the shoulder of the other and gently patted him on the back.

In another field a couple of women worked and smoked their pipes. They did not look up when I passed. The pipes (*Fig. 29*) which we saw are exactly like those of the Pesegem [44] illustrated by van Nouhuys, only the stem is not wrapped. The bowl consists of a hollowed-out fruit and has only a small space for tobacco. Van Nouhuys mentions that *Elaeocarpus* fruits are used for this, but of that I am not certain. Tobacco also is rolled into a kind of cigar or wrapped in a green leaf and smoked thus. One sees tobacco carefully wrapped with *Pandanus* leaves and split rattan and tied up in packages. According to Wirz (l. c. p. 125) this is the commercial form which is purchased with *tigalèhs* by the Meervlakte people. Fermentation is not practiced, the flavor being very sharp.

[44] Van Nouhuys, l. c. Pl. 1, fig. 3; cf. p. 11.

As with many primitive people, so with the Timorini, the name is very important, really an integral part of the person. One hesitates to call himself by name, as if he were yielding a part of his personality; on the other hand, one is in an advantageous position if he knows the name of another, particularly in confidential matters such as barter, since it is apparently understood that the mention of a name is a kind of guarantee for trustworthiness and honor. How weakened this is in our society! However, if one must give a name, it is preferable not to do it oneself but to enlist the help of another. Conversely, we were never directly asked our name but inquiry was made through another person. Nevertheless, these primitive men, who so easily affect a settlement with the higher power, were careless enough in these matters, not taking everything seriously; we saw this in regard to the surnames and we experienced it also in

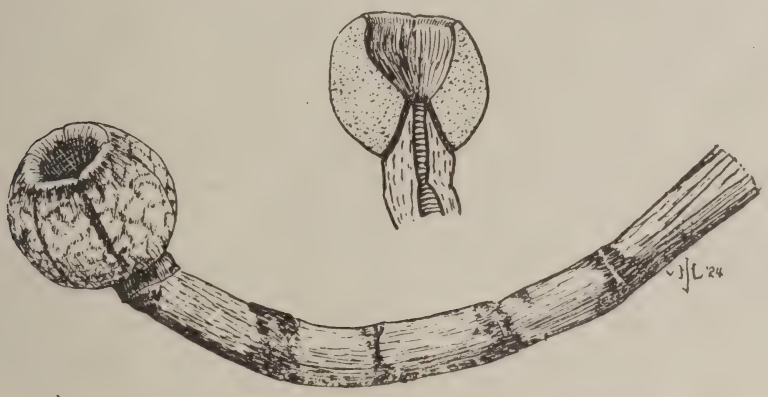

FIG. 29. Timorinese pipe, also a longitudinal section of the bowl.

the play which one—even in this remote region—knew how to make on my family name, jestingly naming me "wam" (pig). This I may consider to have been a great honor, for according to Wirz (l. c. p. 85) "verkörpert sich (in Schwein) nach Ansicht des Papua alles Gute, Reine und Edle," and "wam . . . war daher auch das erste und letzte Wort das ich . . . täglich und zu unzähligen Malen zu hören bekam."

When we thus, for example at mealtime, all sat in a row on our small mattresses in the hut, and the lords of the land then passed in front of us and, as "frequenters of the fair" who were now out for a day and wished to enjoy everything, inspected us as if we were wild animals, handled and examined us, then we felt ourselves to be more as a somewhat ridiculously interesting sight, than as members of the "dominant race." Frequently it was really as if we sat there on exhibit for the pleasure of our hosts, so self-assured they appeared, so convinced of their good right to see everything, as if they had paid a *tigalèh* for it. They came in groups of three or four, all talking, demanding of us, not unfriendly nor whining, but with something commanding in their voices, to open our tins, to empty our sacks of everything, and to hand over our watches and rings. And they rested not until this demand was satisfied; then like children they immediately turned their thoughts and attention to something else. Once we hesitated to trust expensive things such as rings out of our hands, but it was explicitly made clear to us that they only wished to see the article and that it would be returned after a time. Nevertheless, they frequently

hoped that it might be offered as a present, but when this proved not to be the case, they laughed good-humoredly at their misfortune. On the other hand, they were easily pleased with small gifts which had less value for us, for example, small sheets of paper from our notebooks much valued as a substitute for *melli*, shoelaces to be used as necklaces, and milk-tins without top and bottom as armbands. Matches, on the contrary, were not valued. Once on the following day they uneasily returned a small box of matches untouched. Strange material was before their eyes, so thin and yet so strong. When we removed the cover of a baggage-tin, the hollow noise repeatedly frightened them, and I once made a small group solicitous for my welfare by striking my head with such a cover.

During a noon-hour, one of the few annoyingly intrusive men, named Djimaweh, by his insistence discovered one of my glass tubes for preserving material in alcohol. I thought that I would demonstrate that one can produce a whistling sound by blowing such a tube, and that immediately awakened his desire to possess it. Realizing very well that it was of no real value to him, he did not wish to give anything in barter but rubbish; I did not enter into the bargain and would not trust it out of my hands. Finally, somewhat annoyed, he came and stood in front of me, his face set with an expression that meant "I can do without your tube," stuck his fingers in his mouth and tried to imitate the noise; it miscarried so pitifully that he hastily retreated.

I continually produced great surprise with my metal measuring tape, a steel centimeter roll 2 m. long which, with the pressing of a small button, disappears into the case through the action of a spring. Being very much in vogue with "the public," I must repeat this ceremony some ten times a day: I draw the tape out and let it hang down, then I invite one of the "lords of the public" (an uninitiated one) to grasp the end. Because of the laughter and tense expectation of his companions at the somewhat strange preparation, the victim comes somewhat suspiciously nearer, and, with the very complaisant confidence of "I shall not run into it now," slowly and cautiously stretches out his hand. All become very tense, and one could hear a pin drop. Temptingly the tape swings to and fro, but just as his hand makes a grab, I, unnoticed, press the button with my thumb and the tape swiftly vanishes into the case in the twinkling of an eye. A shout bursts from the onlookers, and the victim is noisily taunted but disappears in the crowd. He is the first to avenge the scorn suffered by bringing a new victim.

These people are practical in trading, but they also have their pride. When we did not concur quickly enough with their opinion or were not open-handed enough with our return present for an offered small lot of sweet potatoes or sugar cane, then they would either give it to us as a present and go proudly away, or, without saying a word, would present the article to the Dyaks or soldiers.

With these few and but little coherent anecdotes, I have tried to give a few impressions obtained by a layman in the ethnological field. These perhaps to outsiders, non-professionals such as myself, tell more than a scientific treatise, particularly as they throw light on another side of the matter. I have not by any means striven for completeness. There is no need to consider data which have already been scientifically treated by Wirz. I think therefore that it must suffice to indicate the illustration [omitted] of a grave of which Wirz also pictured a few (l. c. fig. 15, 16), or particularly a fenced-in place where a crema-

tion had taken place. I also give a sketch of a sacrifice-table [omitted] (cf. Wirz, l. c., fig. 13) on which, among leaves, the remnants of meals of pork are offered to the "koegi," the spirits of the ancestors. For further information on the rôle which these "koegi" play in the life of the Timorini, and in general on the animistic ideas which appear to rule them, I refer to the author mentioned (l. c., p. 52 et seq.). Before I close this Fragment with a story of our trip into the principal valley, I here insert a few remarks on the landscape and the original flora.

From the Dika Valley, Doormantop hardly gives the impression of dominating the mountain-series. The entire chain rises as an enormous wall nearby, steep above, heavily covered with vegetation, and deeply cut by numerous ravines, of which the lowest parts of the walls frequently are perpendicular (*Figs. 30, 31*). The high 3820 m. summit is not visible from here, or at least

FIG. 30. Doormantop Chain seen from the Dika Valley.

was not recognized. Relatively soon the Dika Valley shuts off the view to the east, and the Swart Valley (*Fig. 31*) stretches far away to the west. Almost endless is the series of wing-like ridges lying successively behind each other, the comparatively gentle slopes of which suddenly drop off perpendicularly or almost perpendicularly into the narrow gorge containing the sinuous and almost always unseen mountain-river. This erosion-form, which is a distinguishing feature of young mountain-ranges, is very characteristic of this landscape.

The Dika-bivak lay on an open part of the slope. Eastward from there is a very large clearing, westward a smaller one with a few small houses, and in front of us one of the well-kept paths, which have been developed through long years of use and which make traveling in this region so agreeable compared to that through the difficult forested terrain. Toward the east one very soon meets with the old forest. Here we are on the boundary of the inhabited territory; the population is very thinly scattered there and a very small part of the overlying slope is still forested. But to the west in the main valley all is cleared from the margin of the steep gap to very high against the slope. In this part of the mountains the highest limit of inhabited territory lies at about 1800–2000 m., but, more towards the Central Chain, the Kremer Expedition came across kampongs at an altitude of 2800–2900 m., there practically all the forest was cleared. Near the Dika one sees forest on the ridges. Narrow forest-strips have also been left standing along the short streams which cut through the slopes, but, in the little original forest remaining, species of *Pan-*

danus are very common, apparently having been saved on account of their fruits.

The deforested land appears in three forms: as cleared fields, as *alang-alang* [*Imperata*] meadows, and as secondary forest. The last originated either by the extensive destruction of the old forest or by natural reforestation of abandoned fields. In many instances it is not easy to say with which of these two forms one is dealing. But it appears to me that the first type is characterized especially by the large number of tall Leguminosae (*Parkia?*) with white trunks, frequently practically the only tall trees, and a slight undergrowth; whereas the forest on old cleared land now has the character of a shrub wilderness with some smaller trees, then again of a young forest with a thick under-

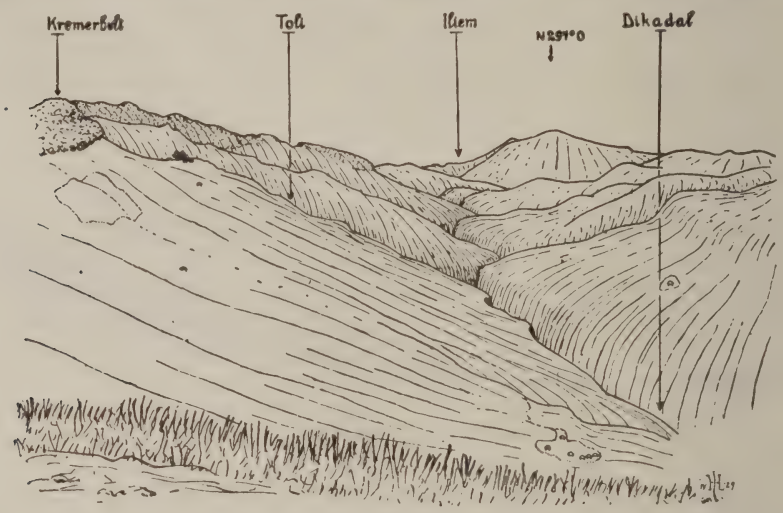

FIG. 31. View through the Dika and Iliem Valleys toward the west; behind the first ridge at the left lies the Toli Valley; below Kremerbult a clearing; right below a kampong; the stippled part of the left ridge farthest back is primary forest; to the right of Kremerbult some houses with large *Araucaria* trees.

growth and often very many ferns. Under the circumstances described, I was scarcely able to collect in this terrain. In a shrub-wilderness I found a few plants of *Callicarpa longifolia* Lamk. (trop. As.—Austr.), a species of *Melastoma* (no. 2060; aff. *M. polyanthum* Bl.), the Australian coniferous *Callitris robusta* R. Br. (no. 2166), and lastly a beautiful *Rhododendron*, a robust shrub with very large orange-red flowers about 10 cm. in diameter. In such places were large masses of *Polygonum chinense* L. (trop. and subtrop. S. E. As.—N. Guin.). In a newly cleared field, I found as epiphytes *Pleopeltis recedens* Moore and *Davallia dissectifolia* J. Sm.

The *alang-alang* fields are treeless, open, and frequently very extensive. In the more thickly inhabited region they certainly occupy the greatest percentage of the land. Apparently they take over old cultivated terrains which, finally, through the loss of humus and through drying out, have become valueless for crops, and the *alang-alang* has hindered the growth of young forest. A few herbs grow in the tall grass, such as *Osbeckia chinensis* L. (no. 2084; trop. As.—Austr.), *Wahlenbergia marginata* DC. (no. 2083; eastern O. W.), *Mitrasacme*

elata R. Br. (N. Guin., Austr.), *Oldenlandia tenelliflora* K. Schum. var. *papuana* Val. (nos. 2065, 2085), and *Burmannia disticha* L. (no. 2079; trop. As.—Austr.). In the margin of the secondary forest I observed *Hydrocotyle javanica* Thunb. (no. 2067; trop. As.—Austr.), *Coleus scutellarioides* Benth. (no. 2058; Arch.—Austr.), *Rubus rosaefolius* Sm. (no. 2062; trop. As.), *Melastoma malabathricum* L. (S. E. As.—N. Guin.), *Desmodium Scalpe* DC. (trop. O. W.), and in addition some species of *Ophiorrhiza*, *Impatiens*, and *Cordyline*. According to Gibbs, *Desmodium Scalpe* DC. must be considered as an introduced plant growing near dwellings.[45] Possibly a few of the other plants named above may be considered as adventive in the broader sense.

The first evening after I arrived in the valley, it was decided to make the proposed five-day trip to the chief valley. With seven days' supply, we still would have a margin of two days to reach Doormantop in case the allocated rations might have spoiled or disappeared. Leaving provisions behind is somewhat risky, since we cannot forsee what people may do with the supplies in our absence, although they are mostly in thickly soldered tins. A newly constructed house nearby was chosen as a storehouse (*Fig. 32, 2*), whose owner, Aligaingenak, was informed of our plans. He apparently was flattered by the trust placed in him and explained, everything in gestures, that he would deliver our property to us intact after four nights of sleep (gesture: the hands flat against each other and against the right ear, the head bent to the right, the eyes closed, further explained by deep breathing or snoring).

This all happens before our departure, yet the report of our unexpected breaking up of camp is already on the way to the chief valley, and everywhere the long extended signal-call re-echoes announcing our coming, before we are even on the march. Immediately the Dika Valley is in a commotion and, from a place where I proceeded to take some pictures, I can see the inhabitants come hurrying out of the kampongs to witness our passage. From this point (*Fig. 32, 3*) there is a beautiful view toward the west (*Fig. 31*). While I am busy taking pictures, four or five young men come running toward me. I am alone. They are not frightened. All are unarmed, and good-naturedly they make a lengthy and loud speech during which they examine all my bags, pull at my clothes, and direct my attention in turn to various objects far away, and then pronounce a word, not content until I have repeated it with the exact pronunciation. After the first inquisitiveness is satisfied, they seem to recall the purpose of their coming and begin to explain to me, all talking at once, that we must not go forward, since the people ahead will be unfriendly to us (cf. Wirz, l. c. 38). However, we are acquainted with this old story. When they see that their efforts are fruitless they stay near and frolic merrily. Our group consists of three fusileers in front, then the Europeans, followed by the convicts, the Dyaks, and finally by three more fusileers. The group proceeds like a long sluggish centipede, only half-projecting above the tall grass along the narrow path. In front and behind the Papuans call to each other over our heads.

Having come to the next ridge, on all sides we see people hurrying along our path. After crossing one of the forest-strips which descends into a small ravine, we approach a grassy incline where three houses are grouped together (*Fig. 32, 4*). The men and youths come out to meet us and offer some food,

[45] L. S. Gibbs, Dutch North West New Guinea (1917) 48.—Miss Gibbs mentions only this ruderal plant.

FIG. 32. Sketch map of the Dika and Toli Valleys; horizontally hatched = primary forest; vertically hatched = secondary forest; l = clearing; g = *alang-alang* field; o = Timorinese houses; – – – – = route followed; explanation of the numbers in the text.

such as roasted banana, or sweet potato, and some small pieces of sugar-cane. The women and girls stand in the rear near the huts. After we have acknowledged our favorable reception, we are considered accessible to the *mbok* story (*mbok* = enemy), but as that appears to be without effect, the inhabitants accompany us cheerfully to the next group of houses. This accompanying and passing on of our party to the dwellers in the next kampongs is continually repeated. The offer of refreshment was made only once. We now approach the small forested summit known to us as Kremerbult (about 1500 m.), since it had served Capt. Kremer as a fixed point in his survey of Doormantop. A small kampong (*Fig. 32, 5*) is located at the corner between the two valleys under a cover of stately *Araucaria* trees. The route ahead is discussed during

a short rest at this place. After we have passed through a strip of forest, we obtain a good view of the Toli Valley [46] for the first time. We can survey some tens of kilometers to where a high mountain chain, 20 to 30 km. distant, runs east and west shutting off the horizon. In this chain the highest peak (3100 m.) is later named van Arkeltop. Ridge after ridge appears before our eyes, and in the valley-bottom is the narrow deep canyon wherein nothing but a small section of river is visible.

We descend a short distance, pass a few houses, where a couple of girls with arms around each other's necks giggle at seeing us pass, and enter again a somewhat cleared small forest-area with a solitary hut on the margin of a field (*Fig. 32, 6*). Later we arrive at a larger kampong (*Fig. 32, 7*), where again some beautiful *Araucaria* trees grow along the path. These trees, here called *tien*, seem to have been planted near the kampongs. It is a pleasant rustic scene. At our approach a pig, which is tied to a *ladang*-fence by a hind foot, tries to escape over it and remains hanging on the other side, squealing wretchedly. A woman hastily comes out of the dirty untidy women's house to free the animal, and we vaguely see through the open door in the inner darkness the figures of vacant-looking old women and the crowding of small children.

After the black mud of the forest-paths, the white or gray lime or clay soil in this valley is pleasant. The paths are hard and smooth. Here and there a milky brook overflows.

Toward eleven-thirty we reach an open place on which stands a large men's house (*Fig. 32, 8*). We find a large company assembled around the fire on the ground. There the leader, with a view to making proper contacts with the population, wishes to make a short day's march. He is resolved to look for a camping place with water here in the neighborhood. While he and the doctor go out, the geologist, the controller, and I have the pleasure of getting acquainted with a company of established citizens, well-mannered and of venerable appearance. They come out of the hut, one at a time without haste, to see and talk with us. The controller has a sudden impulse to unbutton his coat. The astonishment at seeing a white shirt under the coat is great, but the climax is reached when he takes off both coat and shirt, showing a white skin. Each personally must feel him to see whether this is now the final skin. While they in their astonishment bite vehemently on the bent index-finger and tap against the *keboaak*, they have enough scientific skepticism about his integument to verify it by examining the geologist and myself. Among those present were three bearded men, slender and of stalwart posture, conspicuous among the others. We tried to find out about their family relations and they immediately understood what we wished. Each of them struck himself on the chest, then that of another, and finally, not without laughter, grasped the *keboaak* of the oldest. The older man good-naturedly put up with this and affirmed that the two others were his children by the words *an apoet* (my children).

Near this house, in an open secondary forest close to a stream, a suitable camping place is found, and the Dyaks and soldiers busy themselves in erecting a few huts (First Toli-bivak, Fragment I, Map B, no. 18) (*Fig. 32*). Nevertheless it is four o'clock before we eat our meal. The entire midday is spent talking with Papuans, who are always in the way; but the friendly atmosphere is undisturbed and many pleasant minor incidents occurred. There are many

[46] Toli is the name of the part of the Swart River between the Dika and Panara (or Donda?).

children about. One of them, who begs continually but obtains nothing, tries to work on our feelings by simulating a fit of crying behind his hands, peeking between his fingers to see the results of his efforts. The doctor enjoys a great deal of confidence, not only because of his friendliness and tactful approach but also because of his success in healing some persistent wounds and inflammation of the eyes. Thus, this noon, there came a young man with inflamed eyes, led by another who suffered from this same disease. The latter had already been treated a few times with silver nitrate by the doctor. Although it was known that this treatment was painful, various men compelled the youth to submit to it. When he had courageously endured it, a mutter of approval went through the crowd. Repeatedly it was evident to the doctor that his services were valued. Almost always his aid was accepted. Almost always at the end they came with a few sweet potatoes, sugar-cane, or bananas, which—preferably in an aside—were pressed into the doctor's hands. Like the Pesegem,[47] the Timorini, when treated with medicine, blow on the thumb side of the closed fist, apparently the usual conjuration to exorcise the illness. The request for medical assistance is accompanied by this gesture, and it is peculiar that they also blow on the fist when being photographed. Probably the custom originated because they saw the doctor busy taking pictures. The result was that they came to understand photography as a beneficial act, a very favorable circumstance which facilitated the making of photographs in a welcome way. We were very glad to please this crowd of people by clicking the shutter every time they stood before the lens and wished to hear the shutter click.

Somewhat later in the afternoon, when the bustle of building and eating has passed, the older men come out of the large hut quietly to sit in front of the camp; and the doctor makes use of the opportunity to take impressions of hands and feet. None of the Papuans object to it. In giving an impression of their extremities, apparently they saw something entirely different than in the handing over of hair, as we were to see the next day. Moreover, the reward obtained for permitting this was enticing enough. Each one furnishing a hand- and foot-impression, made with printer's ink on a piece of paper placed on a metal plate, received a small quantity of the beautiful black thick-flowing printing ink, in his eyes a much improved form of the usual and indispensable cosmetic: pork-fat with soot. This liking is not so strange when we consider that, as some white folks purposely make themselves as white as possible, dark-colored folks might also wish to make themselves as black as possible. Then, to them, the deep black ink is the peak of splendor, for the Timorinese individual is only dark brown and wholly lacks the intense black color of the negro.

The same afternoon I had a lengthy comedy in negotiation with a tall slender full-bearded man, named Oendigĕnak, one of the brothers who had explained so graphically that morning who his father was. He was a man of quiet nature, one of few words; for a long time he sat silently before us, his clear understanding eyes taking in everything he could see. In some way or other the glass tube, which Djimawèh was very eager to obtain in the Dika-bivak, attracted his attention by the noise which could be produced with it. At first he was loath to give it up, but when his efforts to secure it failed, he beckoned me to accompany him back of the camp. In such transactions the Timorini would not

[47] A. Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, p. 194.

think of spying on each other. Now, secure behind the camp, he wished to examine the tube at ease, and he really exerted himself with words, gestures, and intonations to obtain the gift. When I wished to see how great was his tenacity and whether he would persist in his purpose, I refused; then that part of the bargaining was ended. He took his place in front of the camp again and sat perfectly still opposite me, but whenever I even glanced in his direction, he secretly made a gesture as if blowing on the tube. Suddenly he vanished, but after a time he came back and, as inconspicuously as possible, laid a small bunch of green bananas under a small shrub. Then he sat down a few meters from the bananas and, apparently apprehensive of competition, he did not venture to fix my thought on the proposed barter-article in any other way than by throwing small stones and bits of wood near it, as I watched his side of the group. And when it was dark, he silently vanished with his bananas.

A man with a conspicuously handsome face was among the visitors; in Bijlmer's dissertation (photograph 44) he is described as the "nobleman." This man, named Enggabitme, notwithstanding his dignified aspect, made it very difficult for us with his intrusive familiarity. Without ceremony he crept in between us into the sleeping-quarters of the hut, with perplexing boldness, to rummage through all our possessions. Another, a quiet old man with a silent good-natured smile, suddenly, without ceremony, took my pipe out of my mouth and began to suck it. Such communistic ideas are very general. Often I have seen one, without asking and without being opposed therein, draw the pigs' tusk out of the nose of a comrade and stick it in his own nose. Nevertheless, the dish-washing in the creek by the camp roused an interest as something abhorrent, and bathing held many more astonished spectators.

At eleven o'clock the next day we break camp. A few efforts are made to stop us, but when these fail the Papuans cheerfully lead the way, first chopping a path for a half-hour through light secondary forest, where red *Impatiens* and *Coleus scutellarioides* Benth. occur in the undergrowth. Amongst the shrubs and lianas are a large number of Araliaceae, and here and there are the white trunks of tall Leguminosae. Next we come to an open grass-field with *alang-alang* almost as tall as a man, where even the Dyaks rest, to the great amazement of the Timorini, who repeatedly wish to pass through and pretend to find the Dyaks' loads immovably heavy.

It is a perfect day. A deep blue heaven arches cloudless above the massive bright green sides of the valleys. The fresh morning air is gentle and beneficent and above all is the joy of living, which harmonizes perfectly with the buoyant spirits of these mountain-dwellers. We get the feeling of being on a triumphal march. The path continually offers changing views of the beautiful valley. We have passed an abandoned clearing (*Fig. 32, 9*) and after that a small ravine with a fantastic *Pandanus* forest (*Fig. 32, 10*). On the other side of it we are again waylaid by a large group of men who stand together at the side of the path. The old acquaintances among them come forward with subdued pleasure, but at the same time with expectant dignity, and one by one shake hands with the Europeans. Many still do not recognize me, the latest arrival, and a formal introduction follows, stately and serious. After this ceremony, responded to as solemnly by us, we come again to a meadow (*Fig. 32, 11*); there the giggling women are grouped together somewhat back of the men. We now are approaching a place which we have already seen from a distance; here some mighty transverse ridges with almost level summits and

steep slopes, separated by deep ravines, extend toward the river. In front of us and on the crest of the first ridge we see the silhouette of a new group of waiting men. Here therefore our forward movement is known. After a bare ravine, we climb another grassy slope and halt on the level part. To our astonishment the men whom we saw before have vanished. The bare crest of the ridge is outlined above us against the blue sky. The controller makes use of this rest to photograph the group against the background of the northern chain from Doormantop, the bare crown of which projects above the forested ridge.

Meanwhile the doctor and I are curious as to the cause of the sudden vanishing of the Timorinese group on the ridge; once having climbed up and reached the top, we see the same panorama again but with another foreground, a new transverse ridge with stately tall forest to where it becomes level and crowned with a series of tall trees. However, no trace of men was seen. We took some photographs and looked down the path which leads to the forest-edge, and we asked ourselves what the sudden disappearance of these men could signify. Unwillingly, in such circumstances one thinks of an ambush, but, as quickly as the thought enters our minds, we laughingly abandon it, for two forms emerge out of the darker forest-margin. We beckon to them reassuringly and the two men approach. It appears that one of them is a newcomer; he is so nervous that his whole body trembles and cold perspiration stands in beads on his forehead. We restore his confidence by gestures and shaking hands and by showing him the camera and the folding stand, and when the others arrive, he is entirely over his fear. We proceed together and are soon within the high forest, half clear primary forest and half old secondary forest. At eleven o'clock, on a rounded ridge, bivouac is made (Second Toli-bivak; Fragment I, Map B, no. 19) (*Fig. 32*) in the light shade of tall Leguminosae, under which there is almost no undergrowth. While the hut is being built, the doctor and I go somewhat higher up the slope to talk a little with a group of Timorini who are stretched out there. Now that good feeling dominates, the anthropologist makes use of his opportunity to try to collect samples of hair. He has purposely postponed this to the last, since he feared that it might develop a disagreeable attitude, which, particularly in the beginning, could have damaged the whole undertaking. During five weeks these men had become accustomed to us, and now the chance must be taken. The doctor snipped off a small lock of hair from some men, overcoming the gentle protest by friendliness. An expression of unrest went through the group and there was even blowing on the hands, but small mirrors, small rings, etc., were accepted as reciprocal gifts, and in addition, for each lock of hair the anthropologist very tactfully gave a blond lock of his own in exchange. Nevertheless, it immediately appeared that the doctor's technique was very important, for the blond hair-lock was handled with the utmost care, whereas the earlier owners of the black curls showed the greatest uneasiness during the day about their own hair. Under the direction of the owner, this was carefully wrapped in a small leaf; that leaf was then wound around many times with a string and they were attentive as to where the doctor finally placed the packet. The blond lock was packed with the same care and vanished into the shoulder bag. Thus far all went well and the doctor soon had so much material together that he thought it advisable now to divert their attention, for the feeling of unrest remained and repeatedly they blew on their fists and tapped the *keboaak*. The diversion is

found by showing some small tricks such as balancing a stick on a finger-tip; this causes much admiration and is eagerly tried but without success. Finally the boys bring hot chocolate; we go to bathe in the clear brook back of the camp, after which we eat.

There are many visitors during the entire afternoon. The largest kampong of the region is on the next ridge, and we see ourselves watched till dark by women and children who squat on a large flat stone on the other side of a small ravine. After eating I proceed to reconnoiter the vicinity. Climbing the ridge back of the camp, I find at the top a path leading to one of these small, very steep, recently cleared fields, which one may encounter here and there at the edge of the tilled lands (*Fig. 32, 12*). The slope is sheer, perhaps at an angle of 40°, and terraced; a few sweet potatoes grow among many weeds on the small terraces. Tree-trunks showing the marks of the stone axe lie scattered about. At the left of the field a small stream rushes down, bordered by tall *Pandanus* trees, and the cleared place is surrounded by a fence still white in its newness. In this charming spot I sit down to try and realize fully the significance of this event in my life now, and later when I shall have returned again to my own society, this living in another world, a world which offers so many new impressions that it is altogether like a wonder-world seen in a dream. Here I sit in this field lost in a limitless past, in which the "Annus Domini" tells nothing more. Here I sit alone, before me the green slope in a frame of fine Leguminosae growth, topped by white clouds. Round about me is the work of man, the "diluvii testis"; a few hundred meters distant, there is the contact of this primitive man with the life of 1920, A.D.

On my return to the camp, the doctor was busy with the out-patients' department. Alas, during the consulting hour the drama of the hair-lock began. Seemingly the doctor had surprised them by his earlier procedure. Apparently it had been only owing to his good name and the trust which they had placed in him that the present protest was not more serious. Suddenly a man determinedly stepped up to him and with a brusque gesture returned the blond hair-lock. Pretending to misunderstand did not help. In vain the doctor still tried to prevent the others noticing it, but manifestly it was premeditated, and immediately others arrived who earnestly requested the return of their lock of hair in exchange for that given to them by the doctor. Refusing the last was no longer helpful. Finally the anthropologist was compelled to give up the hair collected with such difficulty.[48] With that the feeling of unrest entirely disappeared.

This all took place during the usual treatment of patients. Occasionally one comes, who has been home after the treatment, and now without saying a word places a few sweet potatoes and pieces of sugar-cane at the doctor's feet. Some women and girls are also in the crowd. A nursing mother quietly smokes her pipe, while she squats somewhat timidly among the crowding men. Toward the end of the afternoon the older women return from the field, heavily loaded with sacks of sweet potatoes and huge *Pandanus* fruits. They walk quickly past without looking up or back. Besides, the men do not permit the women to be too inquisitive, and as they pass by—this applies particularly to

[48] In contrast with this de Kock (Tijdschr. Kon. Ned. Aardrijksk. Gen. XXIX, 1912, 158) reports that the collection of hair-samples among the Goliath Papuans offered no difficulties, since they desire neither beard nor mustache and pull out each small hair. De Kock also scored a great success with a razor.

the younger women—they are pressed back by the men's threatening glances and loud abuse or are even hurried on their way. Towards dark all visitors suddenly disappear, and the evening is again quiet and peaceful, just as it was earlier in the primary forest.

I recall the exhilaration of awakening in this place in the fresh clear morning, where the soft blue sky showed through the pale green filigree-like pattern of the foliage of Leguminosae. At this time we were all in high spirits and none of us will ever forget the five perfect days which we spent in the midst of these mountain Papuans under the most favorable circumstances.

After eating our meal we first pass through the ravine, then come into the large kampong (*Fig. 32, 1*). Already the men await us at the boundary and the women and children stand among the houses. In the center of the kampong where the path widens into a small square, an unstable structure stands, in which a cremation must have taken place a short time ago. Refreshments are offered us, roasted sweet potato, banana, and sugar-cane. Here also a few thin yellowish dogs are running around. After a short stop, the march is continued, led by a large number of excited men. In addition to tobacco, I saw a small planting of *katjang ketjipir* (*Psophocarpus tetragonolobus* DC.). After that we come to a large and well-maintained clearing (*Fig. 32, 13*), and here from a small rock protruding at the top of a steeper slope, we have the first and only view of a small stretch of the Swart River.

Repeatedly forest-ravines alternate with unforested grassy ridges, which are all occupied by a waiting crowd. At each ridge a stop is made and the same scene takes place, introductions, talking, emptying our bags, etc. With all the very human scenes around us, it is difficult for us to reflect that we are in the midst of a "wild" tribe in the unknown interior of New Guinea. When the Dyaks put down their loads, a picture is taken, and a lively barter is carried on. The boldest girls, giggling and with their arms about each others' necks, come slowly nearer, ready to flee away screaming as soon as we look in their direction. The young men, nervous at all the new things, sit around everywhere, wishing to have everything opened, questioning us with their harsh voices, asking more than we can answer; after they have tried in vain to make themselves understood by constantly shouting louder, they finally stick their hands freely into our bags. The older men, with real or more likely feigned indifference, with the air of patriarchs, in groups of three or four, look on with a very dignified manner.

After we have hoped several times in vain that the next ridge will bring the expected view over the south part of the Swart Valley, it finally comes to pass. We cross a broad somewhat cleared ridge full of tree-trunks and then, on the corner between the chief valley and the next lateral one, we see a small kampong (*Fig. 32, 15*), the only one in this region [49] surrounded by a fence, and near it a tall *Araucaria*. A new panorama lies before us, the broad Panara Valley extends to the east, unforested, barren, and with scattered houses. Higher up the scene is closed in by the forest, much cleared at the edge; only a large number of tall *Kentia* [50] palms with white trunks are left. On the other side of the valley is a steep grassy slope which again shuts off the view to the valleys of the more southern tributaries.

[49] Farther inland later we found a number of similar kampongs (above Donda Valley).

[50] Van Nouhuys also calls this tree *niboeng*, but this name rightly belongs to *Oncosperma filamentosum;* cf. my remarks on this name in Fragment V.

In the middle of this region the last camp is pitched (Panara-bivak; Fragment I, Map B, no. 20), and soon visitors appear from all sides. Most are unarmed; these are old acquaintances, but there are also many newcomers who are formally introduced by others to us with exchange of names. Some look at us confidently and unafraid, but most are fearful and nervous. The bravest present themselves. I see them arriving from below, along the winding path, the full-bearded men, dignified and stiff, but under this demeanor they examine everything attentively with sharp glances from afar. Then they lay down their bows and arrows and come undaunted to us, stretch out their hands, and tell us their names. But most lose courage on approaching. I see them arriving still, a small family, man, woman, and a few half-grown children. The man, in front, is clearly as fearful for his prestige as of us. He remains at a distance standing a long time looking at the scene. The luggage and food carried by the woman are laid down; the man adds his bow and arrows, and, while he with nervously tense face stands looking on, the woman and children squat back of him awaiting his orders. Then suddenly a friend comes who fetches him over with the obvious gestures of "it is not so bad; they do nothing to you." Finally he coaxes him along, unwilling still, until he greets us. After the salutation he is relieved and proceeds to look around. One of the foci of interest is the kitchen, not only to observe how the boys cook our rice, but also perhaps to obtain some food or salt for which they are very eager and which they are sure of getting, and lastly, because Amat entices them there—they call him Omat—the one convict who, with his continually merry laugh and his incessant jokes and tricks, stands high in the respect of the Timorini. His reputation goes ahead of us and he is the only one other than we Europeans—and sometimes also the Dyak chief—to exchange regular handshakes with the natives.

During the busiest hours there were probably 150–200 men around the camp. Therewith amusing scenes arose such as I have already mentioned. Even I did not escape the barter rage. Tèrèngĕnak, a quiet young man with irregular features, readily gave me an axe for a pruning knife. There was also a small boy, who came and stood in front of me; he pulled off his only piece of clothing (a small mouth organ hanging on a string around his neck) and offered it to me in exchange for a small ring. The barter took place, and later in the afternoon I met him again and jestingly asked for the ring. Without hesitation he gave it to me, and without asking for his mouth organ in return. With another man I traded a pipe for a pair of tweezers. He immediately saw that this article might be used for pulling prickles out of his feet. As I did not stop at once and light the pipe, he did not understand the purpose of my barter and, astonished, he pointed out with emphasis how I must use it.

The following morning we are awakened at daylight by the Papuans. The weather is less clear than on the previous day and rain is expected. Even now new Papuans continually arrive from the south. They hastily look at everything. It appears that they had anticipated that we would stay here some time; for, as soon as it is clear that we are breaking camp, there develops a feeling of unrest, and various men spread the latest word. Some older men particularly, among whom Bongkokĕlèh, with a cap of cassowary feathers like a hussar's busby, and Ellemběroe, and the crafty Enggabitme shout as loud as possible to each other, and something appears to be said. When we are a half-hour on our way and the last Panara houses are reached, it first becomes

clear to us what they wish. One stops us earnestly and points out that we must not leave before a blood-offering is made. An excited frame of mind exists. It is best to give in and we wait patiently for an hour until finally Enggabitme, panting and perspiring, comes running with a young pig over his shoulders. In a rough count I found about 170 men around us.

Enggabitme lays the pig at our feet, with much show of weariness. The animal has already been shot with an arrow but still lives; that apparently was to make it easy to carry. Now the usual method of killing pigs—the animal is held stretched between two men, while a third shoots it—is not necessary. Enggabitme shoots an arrow with a broad bamboo point into the heart of the animal lying on the ground. The point vanishes entirely into the body and as Enggabitme draws out the arrow, the blood spurts from the wound. With an indifferent countenance he dips two fingers into the wound and hastily gives each of us a smear over the back of the hand. A number of Dyaks prefer to withdraw from the ceremony, but Enggabitme makes it clear to the head-man that he must reciprocate; with obvious aversion Anji Nau satisfies them by smearing blood on the hands of a few Timorini with a hastily cut wood-shaving. With that the rite is ended. According to Wirz (l. c. 86) this is more a conjuration against malicious influences than a demonstration in our honor; it is thus uncertain whether one may speak of "establishing blood-friendship." Moreover, the whole act is not especially solemn, particularly not when, immediately after the ceremony, around us the shout begins for "boeti." Again it is Enggabitme who is the first and boldest to ask for a chopping knife, and it cost us a Dyak *mandau* and the last convict's chopping knife before we are able to proceed unhindered.

Meanwhile it is getting along toward nine o'clock. Practically all the men accompany us part of the way, one of them carrying the pig by the forelegs, on his shoulders. But before we reach the mountain-ridge small groups repeatedly leave us. We proceed through and along a number of new and old clearings and over some partly cleared terrain, until we reach the forested ridge on the angle between the chief and the lateral valley. Here the first large group leaves us. They stand at the side of the path, and as we go along they begin to sing a loud song, the endless repetition of a four syllable refrain with strong emphasis on the fourth tone: ja—wa—ee—já, ja—wa—ee—já, and so on (cf. Wirz, l. c. p. 114).

The path now ascends slowly upward through the forest-margin. Rarely do we even have a view of the valley where the river flows 500 to 600 m. below us. The Papuans take turns carrying the pig. After some hours we pass the highest group of houses in the large kampong (*Fig. 32, 16*). Nearby is a vast cleared place with a plantation of low *Pandanus* plants and in between these is a crop of sweet potatoes (*Fig. 32, 17*). Along the path we saw several large pits with the remains of roasted *Pandanus* fruits. In the forest near here I found acorns and *Castanea* [*Castanopsis*] fruits lying on the ground.

After some time the Timorini became very weary of carrying the pig, and they tried to get the Dyaks or the convicts to take the load. However, when that was not successful, again we saw one of the men with the pig on his back running along in front of us. The animal was laid at the feet of the foremost fusileer, and it was made clear to us that the pig would not be carried farther. It was then decided to skin the animal on the spot and to divide it. This was done, and the Timorini were completely satisfied with the entrails as their part.

After this intermezzo, interest on the part of the Timorini flagged noticeably. Repeatedly small groups had separated from us after the singing of the first song, but now that the pig is divided, only those who live in the more northern kampongs continue further with us. Soon the path lies over a steep decline, and after some time we again reach the old path through the large *alang-alang* meadow. From here our escort consists of only five men, and with them we reach the First Toli-bivak in about an hour. It begins to rain and we decide to remain here. This afternoon there are few visitors. The doctor has only two patients to treat. Enggabitme has profited by the absence of competition and is more troublesome than ever. In strong contrast to his boisterous entrance and his unruly conduct, there sat before us an old man who silently looked at us with a friendly smile. He asked for nothing, but we made him childishly happy with a small box covered with red paper, after which he came out of his shell and told a long story to the controller in a gentle confidential tone. From it we only understood that he considered himself superior to the Meervlakte dwellers who wear ornaments in their noses. In connection with this he pointed to some *tigalèhs* which he carried in his small shoulder bag. It seemed to us an indication that the *tigalèhs* were obtained by barter from the north.

The next morning we are on the march again at seven o'clock, accompanied by the few men who live in the neighborhood. In the kampongs the inhabitants come out to see us, but there is no tumult such as there was at our departure. At ten o'clock we are back in the Dika-bivak. Aligaingenak delivered the supplies which we had left in his care, undamaged and complete. The rest of the day is spent in completing our ethnological collection. Every opportunity exists for this, now that our coming departure has been noised abroad. The market seems weak, and they come hurriedly bringing all kinds of things which we have not seen previously, or for which the price was too high. Dance-plumes of cassowary feathers, cuirass-like shirts made of woven rattan, and various ornaments are brought and displayed before us at the most tempting prices. Only *tigalèhs* and *mellis* have retained their old value.

It is noticeable that the demand for salt suddenly becomes greater. Perhaps in the beginning it was not so manifest, but now that it is discovered in the kitchen, our last bit must be defended against the eager people. Pulle mentions [51] that the Pesegem likewise are fond of salt. Van Nouhuys [52] reports that he searched a long time for the origin of their salt. Finally in a Pesegemese hut he saw a small bundle of leaves (of *Asplenium amboinense*). When he asked about their use, the Papuans burned them before his eyes, then took small quantities of the ash between the thumb and forefinger and placed it in their mouths. The flavor was more like saltpeter than salt, but when van Nouhuys spoke the word "majoe" (also the Timorinese word for salt), that was ostentatiously assented to from all sides. At first the Timorini did not recognize our salt, the usual briquette of Indian government-monopoly salt, since the product which they know is black. The Kremer Expedition brought from the interior a block of a black hygroscopic substance, which, judging by the flavor, must have a high percentage of salt. By analysis the salt-content appeared to be 74%. Wirz gives the following process as the possible origin of this salt-block: a piece of porous wood (from the trunk of a tree-fern or

[51] Pulle, Naar het Sneeuwgebergte van Nieuw-Guinea, 190–191.
[52] Van Nouhuys, Nova Guinea VII, 1 (1913), 10.

perhaps rather from a *Pandanus*) is placed in a salt-spring and then dried by artificial heat. This is repeated for a number of times. Perhaps a combination of the opinions of van Nouhuys and Wirz gives the solution. In Wollaston [53] we read that the members of the mountain-tribe whom he visited laid bundles of fern-fronds in a hot salt-spring, and later took them out and sucked them.

At noon a heavy rain falls, the first since my arrival in the valley. As soon as it is over, we have many visitors, and we try to make clear to the Timorini that, after sleeping twice, we shall go back over the high mountain. They immediately understand that we go away to bring back new knives; and they explain unequivocally that they will accompany us, taking along food for several days and bows and arrows for hunting. After this communication the market falls still more, and they are greatly astonished that we no longer appear to have a great buying capacity. The Dyaks organize popular games into which they draw the Timorini, so as to win from them; but the interest of the latter soon flags and they only wish to go into the kitchen to beg for salt. Old Bongkokelèh, the same fellow who had the final say in Panara, arrives, loaded from head to foot with various ornaments, weapons, and other articles, visibly disappointed when that does not seem to have the slightest influence on our wish to purchase. Towards dark Endaboh (Bijlmer, diss., fig. 49), a friendly unassuming man with a curly beard who has selected me for his confidant (such patronage fell to most Europeans in turn, from both Dyaks and Timorini), still whispering and emphatically confidential, says that he will go along on the journey back.

So the last day of our sojourn breaks, a rest-day for the carriers. The luggage is looked over again for articles to barter in exchange for small souvenirs of these, to us, very remarkable days. At every turn special friends come to say that they will accompany us in the morning. As I return to camp after a bath taken in the stream under the modest inspection of two Timorini, Endaboh calls me aside with a mysterious look and brings me a small bag of sweet potatoes which were hidden in the grass. Following the custom, I offer him a knife as counter-gift, but to my great astonishment he will not accept it. I take the gift therefore to the kitchen, but, notwithstanding his refusal, Endaboh remains, turning away from me as a waiter does who expects a tip. I give him a small bottle with a tightly fitted glass-stopper which he immediately puts into his sack with a familiar nod of the head and a wink. Nevertheless, he seems to be only half satisfied, but he brightens visibly when he sees another native give his whole necklace for a glass-tube, apparently finding that he is better off.

Some very old men come to visit, very gaunt, unusually slow, they stumble forward leaning on long sticks, panting from exertion, the entire bodies wrinkled, with grayish hair and huge *keboaaks*. One of them is about to sit on a stone to rest, and some of the younger men coming to give him a hand sit beside him.

This last morning the leader has decided to hold one more shooting exhibition. At the beginning of the sojourn of the vanguard in the valley, in this way, the people were given an impression of our power, and now again a flattened petroleum tin is bound to a tree as target. The distance is about 50 m., and one of the onlookers is invited to shoot a few arrows at it. After much hesitation

[53] The Geographical Journal XLIII (1914), 255.

he does but misses his mark. We exploit this poor result as much as possible, so as to prepare the bystanders for what is to come. Then the leader kneels and fires five shots in succession at the target. Endaboh stands next to me. At the first shot, all Papuans cringe in terror and more than half run away as fast as possible. Only one of the old men remains sitting, unmoved, he apparently is stone-deaf. Those who remain in the neighborhood stand with their backs to us, their hands closely pressed over their ears. At each succeeding shot new terror strikes them; when all the cartridges are used up, we wink reassuringly at the few men who have waited to examine the results. Endaboh is so frightened that he hesitates to come alone and, as I go to bring him, he takes my hand in his like a child, and so is brought to the tree, which is perforated by five bullets. The bystanders seem to understand very well what has occurred and are greatly astonished. A new cartridge is compared with an empty shell; then it is shown how such a bullet flies through the barrel of a rifle. They also seem to understand that such a bullet can go through a man and can kill him. This inspires new respect; nevertheless, they immediately see the practical use of the weapon and one of the men offers a pig for it.

Notwithstanding their terror, apparently they have sufficient trust in our goodwill, and, directly after the show, when quiet has returned to the camp, the visitors come again. At noon it starts to rain and that drives the visitors home. While it is growing darker, a black figure suddenly looms up before us; he appears to be a newcomer; from his bold story we conclude that he came from Panara; he has heard much of us and is very happy to meet us; he knows exactly how to report what he will see, and finally, after gazing and admiring a long time, he goes away content.

The next morning at daylight we break camp. Naturally we expect a large gathering to depart with us, but singularly, only a few youths appear. During the packing, the departure, and the trip down to the bridge, we do not see another living soul. What the first emphatic agreement and the subsequent absence of each signified has never been clear to us, and it in turn becomes still more enigmatic, since we now know that on the return journey of the Kremer Expedition, the old guide Wamgimi, with his entire family, joined in with the march back to Prauwen-bivak. There he carried on trade with the dreaded Meervlakte dwellers and stayed several days on the Idenburg River (cf. Wirz, l. c. 125).

Our trip back is told in a few words. We spent the first night in the Jachthut-bivak at 1900 m., the second in the Mos-bivak at 3000 m. Here it was cold and rainy, but the following morning we had a last look into the valleys, gloomy and shadowless under a cloudy sky, and we stood long on a projecting rock to gaze below at the Dika slope, of which we now recognized so many details. We located the site of the bivouac and the cleared field and house of Aligaingĕnak, who had stored our supplies.

The third day's march brought us over Doormantop into the old familiar Radio-bivak, not belonging to the other world but to that which we ourselves have made. We left the next morning. For myself, who had spent such delightful days here, this was not without sadness. One more day I roamed over this beautiful plateau to enjoy the recognized flora.

At Radio-bivak we heard that the rattan bridge at Brug-bivak had been carried away by a flood, but that three days later a new one had been constructed. This afternoon the mountain-region remained continually in rain

and clouds, and on the following morning we no longer saw the Wilhelminatop. Then followed a series of leave-takings of formerly known places, the old camps on the desolate uninhabited slope. At Goenoeng Boetak we found the weather somewhat mild, and without hesitation we proceeded to bathe in the stream. Our stay here was made agreeable by the receipt of mail from Java and even by Christmas packages, so that a rest-day was observed "for the carriers."

Thus we returned on Christmas day to Prauwen-bivak, and with that the inland journey was brought to a close.

Appendix [1]

1. LITERATURE

(In the following list, the most important articles published on or with reference to the Expedition are alphabetically arranged—in the original they are given in chronological order.)

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2. STATISTICS OF THE COLLECTION

The collection assembled by the botanist consists of: 1408 numbers of herbarium material in alcohol in zinc tins (Schweinfurth method); 196 numbers of material in 70% alcohol; 84 numbers of fungi and lichens in 70% alcohol; 32 numbers of algae in 0.3% chromic acid and 0.3% acetic acid; and 10 numbers of fungi in 3% formaldehyde: total 1730 numbers; also 90 numbers of living plants from warmer regions and 31 numbers of fresh seeds or fruits; in addition flowers of 276 herbarium-numbers in 70% alcohol; wood samples of 33 numbers, and galls 20 numbers; finally 8 soil-samples from Pionier-bivak, the forest-margin of the Meervlakte, the foothills and Dika Valley, and some stone-samples from Doormantop.

With respect to the 1730 numbers of botanical material, I shall adopt the provisional lists of Versteeg [2] and von Roemer [3] for purposes of comparison of the sequence of the families:

Versteeg (number of species)		von Roemer (total numbers: 1345)	
Orchidaceae	130	Pteridophytes	155
Rubiaceae	38	Orchidaceae	131
Zingiberaceae	31	Fungi	80
Urticaceae	16	Mosses	69
Araceae	15	Zingiberaceae	66
Asclepiadaceae	13	Urticaceae	49
Euphorbiaceae	13	Gramineae	34
Leguminosae	12	Rubiaceae	34
(Pteridophytes, Fungi, and mosses not collected)		Melastomataceae	33
		Begoniaceae	30
		Ericaceae	29
		Myrtaceae	29
		Coniferae	22
		Araceae	20
		Leguminosae	20

My own collection has been placed in 109 plant families. With reference to the relation of numbers and species, it can be mentioned that, of 19 families studied thus far, 467 numbers appear to represent 285 species, of which 103 are new. In the Pteridophytes the 344 numbers belong to 204 species, of which 66 are new.

[2] Maatsch. t. Bevorder. v. h. Natuurk. Onderz. d. Ned. Kol. Bull. no. 57 (1907), p. 17.
[3] Ibidem, Bull. no. 63 (1910), p. 23.

Here follows the arrangement of the principal families with the number of collections:

Pteridophytes (Filices, Lycopodiaceae, Selaginellaceae, Psilotaceae, Equisetaceae)	344	Zingiberaceae	34
Orchidaceae	250	Urticaceae	33
Fungi and Lichens	140	Algae	31
Rubiaceae	103	Araceae (all but one of lowland habitat)	29
Mosses (Musci and Hepaticae) (57 above 1300 m.)	79	Euphorbiaceae	25
Ericaceae (36 above 1300 m.)	39	Moraceae	25
Cyperaceae	34	Melastomataceae	23
Gramineae	34	Acanthaceae	20
		Coniferae (18 above 1300 m.)	20
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		Myrtaceae (13 above 1300 m.)	18

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